S246–0118–00

6400 Line Matrix Printers

ASCII Programmer's Reference Manual

First Edition (September 1995)

The following paragraph does not apply to any other country where such provisions are inconsistent with local law.

INTERNATIONAL BUSINESS MACHINES CORPORATION PROVIDES THIS PUBLICATION "AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. Some states do not allow disclaimer of express or implied warranties in certain transactions, therefore, this statement may not apply to you. Requests for IBM publications should be made to your IBM representative or to the IBM branch office serving your locality. If you request publications from the address given below, your order will be delayed because publications are not stocked there.

IBM welcomes your comments; please send your comments to:

The IBM Printing Systems Company
Information Development
Department 582, Building 004L
P.O. Box 1900
Boulder, CO 80301-9191, U.S.A.

When you send information to IBM, you grant a nonexclusive right to use or distribute the information in any way IBM believes appropriate without incurring any obligation to you.

Table of Contents

3 Epson FX–1050 Emulation

4 P–Series Printer Emulation

5 Serial Matrix Printer Emulation

6 P–Series XQ Variant Printer Emulation

7 Graphics

8 Vertical Page Formatting

Appendices

Notices

References in this publication to IBM* products, programs, or services do not imply that IBM intends to make these available in all countries in which IBM operates. Any reference to an IBM product, program, or service is not intended to state or imply that only IBM's product, program, or service may be used. Any functionally equivalent product, program, or service that does not infringe any of the intellectual property rights of IBM may be used instead of the IBM product, program, or service. The evaluation and verification of operation in conjunction with other products, except those expressly designated by IBM, are the responsibility of the user.

IBM may have patents or pending patent applications covering subject matter in this document. The furnishing of this document does not give you any license to use these patents. You can send license inquiries, in writing, to the IBM Director of Commercial Relations, IBM Corporation, Purchase, NY 10577, U.S.A.

Electronic Emission Notices

Federal Communications Commission (FCC) Statement

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense.

Properly shielded and grounded cables and connectors must be used in order to meet FCC emission limits. IBM is not responsible for any radio or television interference caused by using other than recommended cables and connectors or by unauthorized changes or modifications to this equipment. Unauthorized changes or modifications could void the user's authority to operate the equipment.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Canadian Department of Communications Compliance Statement

This equipment does not exceed Class A limits per radio noise emission for digital apparatus, set out in the Radio Interference Regulation of the Canadian Department of Communications.

Operation in a residential area may cause unacceptable interference to radio and TV reception requiring the owner or operator to take whatever steps are necessary to correct the interference.

Avis de conformité aux normes du ministère des Communications du Canada.

Cet équipment n dépasse pas les limites de Classe A d'émission de bruits radioélectriques pour les appareils numériques, telles que prescrites par le Réglement sur brouillage radioélectrique établ par le ministére de Communications du Canada. Léxploitation faite en milieu résidential peut entraîner le brouillage des réceptions radio et télé, ce qui obligerait le propriétaire ou l'opérateur à prendre les dispositions nécessaires pour en éliminer les causes.

United Kingdom Telecommunications Compliance Act

This equipment is approved under approval number NS/G/23/J/100003 for indirect connections to the public telecommunications systems in the United Kingdom.

New Zealand Compliance Statement

This is a Class A computing device and shall not be located at a distance closer than 20 meters from the boundary of a residential property.

Trademarks and Service Marks

The following terms, denoted by an asterisk (*) in this publication, are trademarks of the IBM Corporation in the United States or other countries or both.

IBM
Proprinter
SCS

The following terms, denoted by a double asterisk (**) in this publication, are trademarks of other companies:

Dataproducts	Dataproducts, Inc.
Epson	Epson Seiko Corporation
GW–BASIC	Microsoft Corporation
Microsoft	Microsoft Corporation
IGP	Printronix, Inc.
PGL	Printronix, Inc.
Printronix	Printronix, Inc.
P–Series	Printronix, Inc.
Code V	QMS, Inc.

1 Introduction

Chapter Contents

About This Manual

This manual is designed so that you can quickly find the information you need to program the IBM ASCII 6400 printer. Brief descriptions follow for each chapter in this book:

- **Chapter One, Introduction.** Provides an overview of this book, printer features, and line matrix printing technology.
- **Chapter Two, IBM Proprinter** III XL Emulation.** Describes the Proprinter III XL control code commands that you can send to the printer through the host data stream. These commands allow you to send instructions to the printer and configure many Proprinter III XL emulation parameters.
- **Chapter Three, Epson** FX–1050 Emulation.** Explains the Epson control code commands that you can send to the printer through the host data stream. These commands allow you to send instructions to the printer and configure many Epson FX emulation parameters.
- **Chapter Four, P-Series** Emulation.** Covers the P–Series control code commands that you can send to the printer through the host data stream. These commands allow you to send instructions to the printer and configure many P–Series emulation parameters.
- **Chapter Five, Serial Matrix Emulation.** *This emulation can be used only with IBM 6400 printers.* Covers the Serial Matrix control code commands that you can send to the printer through the host data stream. These commands allow you to send instructions to the printer and configure many Serial Matrix emulation parameters.
- **Chapter Six, P–Series XQ Variant Emulation.** *This emulation can be used only with IBM 6400 printers.* Covers the P-Series XQ Variant control code commands that you can send to the printer through the host data stream. These commands allow you to send instructions to the printer and configure many XQ emulation parameters.
- **Chapter Seven, Graphics.** Consists of overview information about Bit Image graphics printing and programming. Descriptions are provided for designing a bit image pattern, using control codes to set bit image density, and issuing commands for bit image programming. A bit image sample program is included.

- **Chapter Eight, Vertical Page Formatting.** Includes information on programming and using vertical format unit (VFU) programs that regulate vertical paper movement and vertical tabs for printing forms.
- **Appendices.** Several appendices provide information on migrating from previous printers to the IBM 6400 ASCII printer and attaching several types of host computer to your printer. In addition, codes pages for the character sets available with each emulation are provided. A Glossary and Index follow the appendices

How to Use This Manual

You can locate information four ways:

- Use the **Table of Contents** at the front of the manual.
- Use the **Chapter Contents** listed at the front of each chapter.
- Use the **Index** at the back of the manual for references to topics and tasks described in this manual.
- Use the **Glossary** at the back of the manual to find definitions for commonly used terminology.

Notes and Notices

For your safety and to protect valuable equipment, it is very important that you read and comply with the notes and notices included in this manual. Descriptions for each type of notice follow:

DANGER

A danger notice calls attention to a situation that is potentially lethal or extremely hazardous to people.

CAUTION

A caution notice calls attention to a situation that is extremely hazardous to people because of some existing condition.

WARNING

A warning notice indicates the possibility of damage to a program, device, system, or data.

IMPORTANT

Important draws your attention to information vital to proper operation of the printer.

NOTE: A note gives you helpful tips about printer operation.

Related Documentation

The following manuals provide information that is closely related to the ASCII emulation information provided in this book:

The *IBM 6400 Line Matrix Printers Setup Guide* (S246–0116) describes how to unpack, install, and configure the 6400 printer. This manual explains the menus that allow you to select a printer emulation and configure printer emulation options. Proprinter III XL, Epson FX–1050, P–Series, Serial Matrix, and P–Series XQ emulation menu options are described in detail.

The *IBM 6400 Line Matrix Printers Operator's Guide* (S246–0115) provides descriptions of the operator panel keys and LCD display. Procedures are provided for daily printer operations such as loading paper, replacing the printer ribbon, and cleaning the printer. Some configuration menu information is provided.

The IBM 6400 ASCII Line Matrix Printer

The IBM 6400 printers are line matrix printers. They use a variable-speed shuttle, micro-step paper feed control, and multi-phase hammer firing to generate a wide range of horizontal and vertical dot densities with no speed penalties. For a brief discussion of line matrix printing, see page 1–8.

Most line printers have specialized architectures that enable them to emulate, (behave like) another printer. These specialized architectures are restricted. Your IBM printer, however, introduces an open architecture in which many different emulations may be selected from the operator panel. Proprinter III XL, Epson FX, P–Series, P–Series XQ Variant, and Serial Matrix emulations are all provided.

Host Interfaces and Emulations

The IBM 6400 ASCII printer supports several host interfaces and emulations, as described below.

Host Computer Interfaces

The following host computer interface choices are available:

- PC–Parallel interface
- RS–232 serial interface
- RS–422 serial interface
- Dataproducts parallel interface

Printer Emulations

Each emulation provides a different set of configuration menus, control codes, and character sets. The following printer emulations (or protocols) are selectable at the operator panel:

- Proprinter III XL emulation
- Epson FX emulation
- Serial Matrix emulation
- P–Series emulation
- P–Series XQ Variant emulation

The following printer emulations are available as features :

- PGL (Printronix Graphics Language) emulation
- Code V Graphics Language emulation

Standard 6400 Printer Features

Several standard features are provided with the IBM ASCII 6400 printers, as described below.

Text Formatting and Language Options

You can modify several parameters used primarily for printing text, either by means of the host data stream or the configuration menus:

- Selectable print quality
- Selectable forms length and width
- Character-by-character attribute specification
    1) Selectable pitch: normal, expanded, and compressed
    2) Emphasized (shadow) print
    3) Bold print
    4) Overscoring
    5) Single underline
    4) Superscript and subscript printing
- Resident multinational character sets

Graphics and Vertical Formatting

Brief descriptions follow for some graphics and vertical format capabilities:

- Bit Image graphics is provided for the Proprinter III XL, Epson FX, and Serial Matrix emulations.
- Plot mode graphics is provided for the P-Series and P-Series XQ Variant emulations.

- Programmable electronic vertical formatting provides rapid vertical paper movement to specified lines for printing repetitive and continuous forms. The following two methods are provided:

  1) Vertical tab table: a set of programmed vertical tabs for use with the IBM Proprinter III XL, Epson FX, and Serial Matrix emulations.

  2) Electronic Vertical Format Unit (EVFU): a vertical formatting program available with the P–Series and P-Series XQ Variant emulations.

Diagnostics

The *Setup Guide* for each printer discusses the following diagnostic features in more detail:

- Built-in diagnostic self-tests
- Configuration printout
- Data stream hexadecimal code printout

Line Matrix Printing Overview

The IBM 6400 printers are impact printers; they create characters by printing ink dots on paper. The dots are printed on an invisible matrix mapped in printer memory. (See Figure 1–1.) Dot impressions are made by an array of steel hammers mounted on a rapidly oscillating shuttle. The hammers strike the paper through a moving ink ribbon.

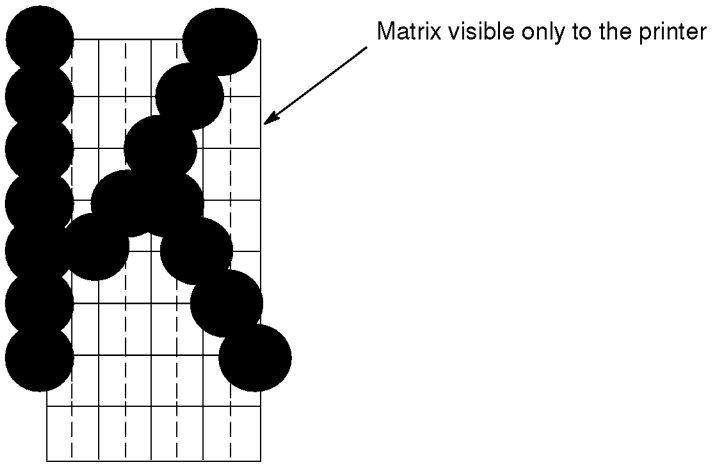


Figure 1–1. Dot Matrix Character Formation

Unlike serial dot matrix printers, which form whole characters one at a time with a moving printhead, the 6400 printers divide every printable line into horizontal dot rows. These printers print a dot row of the entire line with every lateral sweep of the shuttle. (See Figure 1–2.)

During each sweep of the shuttle, the hammers print dots at the required positions in the dot row. When the shuttle reaches the end of a sweep, it reverses direction, the paper is advanced one dot row, and the hammers print the next row of dots as the shuttle sweeps in the opposite direction.

After a line of characters is printed, hammer action stops while the paper is advanced to the first dot row of the next print line. The number of rows allowed for line separation depends on the line spacing you select.

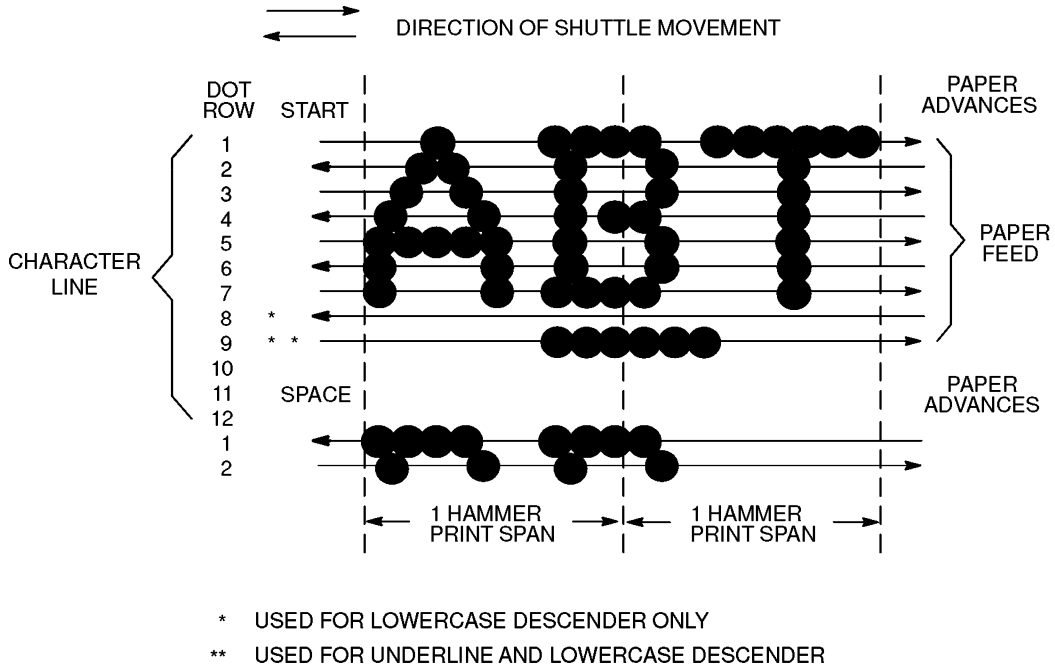


Figure 1–2. Dot Matrix Line Printing

Printing Speed

The speed at which text prints is measured in lines per minute (lpm). This speed is directly proportional to the number of dot rows required to produce a character line, regardless of the number of characters in the line. More dot rows are required to print lowercase characters with descenders; consequently, those character lines print at a fractionally lower rate.

The IBM 6400 printers also print dot-addressable graphic images. The speed at which graphics are plotted is measured in inches per minute (ipm). Unidirectional plotting produces slightly better print quality, and takes about twice as long as bidirectional plotting. You can select either plotting mode from the operator panel.

Printing and plotting rates also vary according to the print quality you select. Print quality refers to the way you instruct the printer to create characters. If, for example, you select near letter quality (NLQ), the printer uses more dot rows to form characters than if you choose high speed (HS) print quality. Character formation and print speed are faster in HS because the printer uses fewer dot rows to form characters. Vertical dot density is thus a factor in printing speed. Nominal printing rates are charted in Appendix A of the *IBM 6400 Setup Guide*.

2 IBM Proprinter III XL Emulation

Chapter Contents

Overview

This chapter describes the Proprinter III XL emulation host control codes that are supported for the IBM 6400 printers. Emulation refers to the ability of a printer to execute the commands of a particular printer control language. A printer control language is the coding system used to convey, manipulate, and print data. Carriage Return, print quality, character attributes such as bold and underline, margins, and tabs are typical functions selected by printer control language codes. In this manual, the terms emulation, printer protocol, and printer control language are synonymous.

In Proprinter III XL emulation mode, the 6400 printers can print files coded for the Proprinter III XL printer control language. To select the Proprinter III XL emulation mode as the active printer configuration, refer to the ASCII Emulation Selection menu option described in Chapter 4 of the *IBM 6400 Line Matrix Printer Setup Guide* (S246–0116).

The Proprinter III XL emulation provides many configurable parameters. The default parameter values for this emulation are shown in Table 2–1. You can modify these parameter values in two ways:

- **The Proprinter III XL host control codes.** An extensive set of Proprinter III XL control code commands can be sent to the printer from an attached host computer via the host data stream. Most of this chapter is devoted to describing the Proprinter III XL control code commands.
- **The printer configuration menus.** You can modify a subset of the Proprinter III XL emulation parameters using the printer configuration menus, operator panel keys, and LCD display, as described in the *Setup Guide*.

Control codes sent from a host system generally override previous settings that result from the configuration menus. However, any configuration settings from host control codes will be gone once the printer is powered off (or reset to the default values), unless you have saved them to NVRAM using the configuration menus. The *Setup Guide* describes the Save Custom Sets option for saving changes to NVRAM.

The emulation's response to several of the control codes depends on the configuration. For example, upon receipt of the carriage return control code, the emulation will either perform a carriage return function only, or a carriage return and line feed, based on the configuration for the CR function.

Default Values and States

Your printer's onboard memory stores a set of typical operating states and conditions for the Proprinter III XL emulation. When you power on the printer and select this emulation, the factory settings in Table 2–1 are automatically invoked.

Table 2–1. Proprinter Emulation Default Settings

Characteristic	Default Setting
Print Language	0437 PC Character Set
Alternate Character Set	PC Character Set 1
Define CR Code	CR = CR
Auto Line Feed	Enable
Define LF Code	LF = LF
FF Valid at TOF	Enable
20 CPI Condensed	Enable

Table 2–2 lists several additional default settings for parameters that are provided by the Print Format menus (described in Chapter 4 of the *Setup Guides*). Many of the settings shown in Table 2–2 can be overridden by Proprinter III XL host control codes for the same parameter.

Table 2–2. Print Format Default Settings

Characteristic	Default Setting
CPI	10.0
LPI	6.0
Forms Width	Inches, 13.6 inches MM 345.4 mm Char. 136 characters
Forms Length	Inches 11.0 inches Millimeters 279 mm Lines 66 lines
Print Quality	DP Quality
Proportional Spacing	Disable
Italic Print	Disable
Slashed Zero	Disable
Left Margin	0 columns
Right Margin	0 columns
Bottom Margin	0 lines
Perforation Skip	Disable

Proprinter III XL Emulation Exceptions and Differences

Because of mechanical differences between your printer(s) (line matrix printers) and IBM Proprinters (moving printhead serial matrix printers), some IBM Proprinter features are approximated or not supported.

- Proprinter codes that produce different behavior in your printer from an IBM Proprinter are indicated by a "dagger" (†) in the Control Code Index and code section.
- Table 2–3 in the following subsection summarizes the results that occur when several control codes that regulate print attributes such as bold, condensed print, etc. are combined. The results from the print mode combinations are shown for both a standard IBM Proprinter and a 6400 printer in Proprinter III XL emulation mode. Results that are unique to the 6400 Proprinter emulation are shown in *underlined italics*.
- Downloadable and user–defined fonts are not supported for the 6400 Proprinter III XL emulation.
- Emphasized, bold, and double–strike are equivalent in 6400 printers; each is implemented differently for the IBM Proprinter.
- When a single backspace control code follows one of the Bit Image Graphics commands (ESC K, ESC L, ESC Y, ESC Z), IBM 6400 printers backspace to the last character position at the end of the graphics data printout. The IBM Proprinter backspaces to the beginning of the line, at the beginning of the graphics data.
- After a backspace, IBM 6400 printers will overstrike a character preceded by a control code (such as bold or proportional) with a partially or incorrectly formed letter. The IBM Proprinter overstrikes properly in this situation.

Combining Print Modes

You can request many print modes (i.e. character attributes such as compressed, NLQ, and super/subscript printing) via control codes. When several modes are combined, all may take effect; however, with certain combinations of print modes, some modes may take priority while others are ignored.

The results from combining different print modes are shown in Table 2–3, for the IBM Proprinter and for the 6400 printers in Proprinter III XL emulation mode. 6400 results that differ from the IBM Proprinter results are shown in *underlined italics*.

Table 2–3. Print Mode Priority Table

Print Mode Combination	IBM Proprinter Result	IBM 6400 Result
Compressed, 12 CPI	20 CPI (If setting 6 of the Printer-Function Menu is Off.) 12 CPI (If setting 6 of the Printer-Function Menu is On.)	20 CPI[1]
Compressed , 12 CPI, NLQ (Serif/Non Serif)	20 CPI (If setting 6 of the Printer-Function Menu is OFF) 12 CPI, NLQ (Serif/Non Serif) (If setting 6 of Printer-Function Menu is ON)	*17.16 CPI NLQ (Serif/Non Serif)*
Emphasized, Compressed	Emphasized	Emphasized[2], *Compressed*[1]
Compressed, NLQ (Serif/Non Serif)	Compressed	Compressed, *NLQ (Serif/Non Serif)*
Emphasized, NLQ (Serif/ Non Serif) Compressed	Emphasized, NLQ (Serif/Non Serif)	Emphasized, NLQ (Serif/Non Serif), *Compressed*

1 If the condensed print feature is disabled via the operator panel (described in Chapter 4 of the *Setup Guides*), then compressed print will not occur (the default setting for Condensed Print is enabled). See page 2–28 for several examples of compressing initial print sizes (5 cpi, 6 cpi, etc.).

2 Emphasized, bold and double–strike are equivalent for the 6400 Proprinter III XL emulation.

continued next page

Table 2–3. Print Mode Priority Table *(continued)*

Print Mode Combination	IBM Proprinter Result	IBM 6400 Result
Super/Subscript, Double Strike	Super/Subscript	Super/Subscript, *Bold*[2]
Super/Subscript, NLQ (Serif/Non Serif)	Super/Subscript	Super/Subscript, *(Serif/Non Serif)*
Super/Subscript, 12–High Characters	Super/Subscript, Graphic with Top 8 Dots Only	Super/Subscript, *12–High Characters*[3]
Over/Underscore 12–High Characters	12–High Characters	12–High Characters
Double–High, Draft	Double–High, NLQ Sans Serif	Double–High, *Draft*
Double–High, 12 CPI	Double–High, 10 CPI	Double–High, *12 CPI*
Double–High, Compressed[1]	Double–High, 10 CPI	Double–High
Double–High, NLQ Serif	Double–High, NLQ Non Serif	Double–High, *NLQ Serif*
Double–High, Super/Subscript	Double–High	Double–High
Double–High, All–Points–Addressable Graphics	All–Points–Addressable Graphics (Single Line Feed)	All–Points–Addressable Graphics (Single Line Feed)
NLQ Serif,12 CPI, Bold	NLQ Serif, 12 CPI	NLQ Serif, 12 CPI, *Bold*
Double–Wide, NLQ Serif	Double–Wide, NLQ Sans Serif	Double–Wide[4], *NLQ Serif*
Proportional Space, NLQ Serif	Proportional Space, NLQ Sans Serif	Proportional Space, *NLQ Serif*
Proportional Space, 12 CPI	Proportional Space	Proportional Space
Proportional Space, Condensed	Proportional Space	Proportional Space

1 If the condensed print feature is disabled via the operator panel (described in Chapter 4 of the *Setup Guides*), then compressed print will not occur (the default setting for Condensed Print is enabled). See page 2–28 for several examples of compressing initial print sizes (5 cpi, 6 cpi, etc.).

2 Emphasized, bold, and double-strike are equivalent for the 6400 Proprinter III XL emulation.

3 12–high characters (with a vertical height of 12 dots) occur in code pages 437 and 850, positions 176–223 and 244.

4 See page 2–33 for several examples of expanding initial print sizes (5 cpi, 6 cpi, etc.).

Configuring the Proprinter Emulation with Control Codes

The remainder of this chapter describes the Proprinter III XL printer control language codes that may be sent from a host computer attached to the printer, in order to invoke and configure numerous Proprinter III XL emulation functions.

Format for Control Code Descriptions

The following information is listed for each control code (where applicable):

Name The title or function of the command.

ASCII Code The ASCII mnemonic for the command. Command sequences are in 7-bit (ASCII) form.

Hex Code The code or command sequence in hexadecimal numbers.

Dec Code The code or command sequence in decimal numbers.

Expression The control codes used in the BASIC programming language.

Purpose The function(s) of the control code.

Discussion A discussion of the uses of the code or command sequence, including exceptions or limitations to its use.

Example A sample program written in BASIC programming language is provided when it is possible to illustrate the effect of a control code or if a specific syntax is required. The programs in this chapter were run on an IBM Personal Computer using Microsoft** GW-BASIC** version 3.22.

IMPORTANT

All print samples in this chapter were run on an impact printer that has a dot resolution of 1/60–inch horizontally and 1/72–inch vertically.

WARNING: If you specify any parameters for a control code other than the ones that are defined in the control code description, unpredictable results may occur.

NOTE: The PI line is never recognized in Proprinter III XL Emulation mode.

Escape Control Codes Overview

Printer capability is greatly increased by the use of escape control code sequences. Escape sequences always begin with the ASCII escape sequence introducer, ESC (hex 1B). Many of the ASCII control codes described in this chapter are escape sequences.

IMPORTANT

An Escape code can occur anywhere in the datastream and is acted upon immediately if it precedes a valid command.

An ESC sequence introducer in the data stream signals the printer to wait for special instructions, even if it is ready and printing. The character codes following the ESC character tell the printer what to do.

NOTE: For readability, code sequences appear in this manual with spaces inserted between command elements. Do not insert spaces between code characters when you are programming unless the ASCII space character (SP) is part of a code sequence. For example, a code sequence printed in this manual as ***ESC [1*** is programmed as ***ESC[1***

An escape sequence uses two or more bytes to define a specific printer control function. The format for an escape sequence is:

ASCII	**ESC**	**X**	**n**
Hex	1B	00 – 5F	0 – FF
	Escape Sequence Introducer	Character(s)	Numerical parameter(s)

After the ESC character are one or more characters which indicate the action of the control code. One or more numerical parameters may in turn follow these characters. For example, the sequence ***ESC S n*** tells the printer to begin the superscript print attribute if *n* is an even number, or to begin the subscript attribute if *n* is an odd number.

If the characters following the ESC code are not within the defined ranges, or if they are within the defined ranges but not recognized as a function of this printer, the entire sequence is ignored.

Graphics Control Codes Overview

The individual control codes that set graphics print quality are described starting on page 2–20. Some additional background information about graphics printing for the Proprinter III XL emulation is provided here.

The Proprinter III XL emulation provides one data protocol for printing graphics information; the Bit Image graphics protocol allows an image block to be printed. When using the Bit Image protocol, you can mix text and graphics on the same line.

Setting Bit Image Modes via Control Codes

Control codes select bit image modes. The following bit image modes can be mixed on the same line as text characters:

Control Code	Bit Image Mode
ESC K *n1 n2* data	Normal density
ESC L *n1 n2* data	Double density
ESC Y *n1 n2* data	Double density, double speed
ESC Z *n1 n2* data	Quadruple density

Parameters *n1* and *n2* together represent a 16-bit (hexadecimal) unsigned number of the quantity (*n1* + 256*n2*), which equals the number of bit image characters (i.e. data bytes) to follow. If *n1* and *n2* are programmed so that data extends past the last character position, the data is truncated at the last character position. If *n1* and *n2* are both zero, then the ESC sequence is ignored.

See Chapter 7 for details on Bit Image graphics.

Dot Density Versus Printing Speed

When you select ESC K (normal density), the dot columns are printed at 60 dots per inch (dpi) horizontally and 72 dpi vertically. This does not decrease printing speed.

If ESC L (double density) is selected, the dot columns are printed at 120 dpi horizontally and 72 dpi vertically. Double density reduces printing speed by one half.

With ESC Y (double density, double speed), dot columns are printed at 120 dpi horizontally and 72 dpi vertically, but adjacent dots are not printed. Double density, double speed does not decrease printing speed.

When ESC Z (quadruple density) is selected, the dot columns are printed at 240 dpi horizontally and 72 dpi vertically. Quadruple density reduces printing speed by one half.

All line-by-line character print attributes are ignored in Bit Image graphics. The most significant bit for each data character is the uppermost dot position in the vertical dot image pattern. A bit value of 1 indicates a dot; a value of 0 indicates a blank. In 7-bit RS-232D serial interface protocol, the most significant bit (bit 8) is cleared to 0.

Code Page and Character Set Control Codes Overview

A code page is a set of symbols consisting of letters, numbers, and graphic elements. For the Proprinter III XL emulation, the IBM 6400 ASCII printers support characters from IBM's Code Page 0437 and Code Page 0850, among an extensive array of different print quality and print language sets. The print language sets are selected using the Print Language configuration menu option, which is described in detail in your *Setup Guide*.

Appendix D provides print samples for each character set, shown in NLQ Serif mode and additional modes in some cases. A table on page 2–13 provides detailed notes on print mode support for each character set.

Two columns of characters, 80 to 9F, may be configured as either control codes or printable symbols. The following control codes are used to configure this option:

Control Code	Character Set Selected
ESC 7	Character Set 1 (80–9F configured as control codes)
ESC 6	Character Set 2 (80–9F configured as printable symbols)

Fault Detection

If the printer detects a fault condition while processing a control code, the operator panel displays an appropriate message, the **Attention** indicator lights, and an audible alarm sounds if it was enabled as part of printer configuration.

After a fault condition is corrected, press **Clear** to return the printer to the Not Ready mode, or press **Start** to return the printer to the Ready mode. Data that were in the printer buffer when the fault occurred will print, but may be distorted or illegible as a result of the fault.

Fault conditions are described in the *Operator's Guide* and *Setup Guide*.

Ignored and Reserved Codes

The control codes recognized by the 6400 Proprinter III XL emulation software are described in this chapter. Control codes not described in this chapter are undefined and ignored. In addition, codes that represent printable characters (Hex 10, 11, 15, 21–7E, and 80–FF) are not available as Proprinter III XL control codes.

WARNING: Entering control codes that are not defined in this chapter may produce unpredictable results.

The following control code is ignored as a Proprinter III XL control code, but is valid for the Serial Interface Protocol:

Hex Code	ASCII Code	Function
03 or 1B 03	ETX	If this code is used in the Serial Interface Protocol (SIP), the SIP function takes precedence.

The Download Characters control code is a reserved code. It is not implemented at this time. When implemented, this code is usually followed by large blocks of data. The Proprinter III XL emulation will currently ignore this control code and any data applicable to it. The Hex and ASCII codes for this function are as follows:

Hex Code	ASCII Code	Function
1B 3D	ESC =	Download Characters

NUL Code

NUL (Hex 00) is ignored by the printer and can be used as a fill character; however, it can not be used to add blank spaces since it is not a space character. NUL can also be used as a parameter terminator for the Set Horizontal Tabs (page 2–61) or Set Vertical Tabs multibyte control code (page 2–63).

NOTE: Hex '80' in the 0437 PC Character Set and Hex '7F' in the 0850 PC Character Set are treated as a NUL; however, these two controls can not be used as parameter terminators.

Print Modes Supported for Character Sets

Following is a summary of which print modes are supported for the Proprinter III XL character sets. An "X" indicates support for a print mode. Additional information about character set support is provided under the heading "Notes." Appendix D shows each code page in NLQ Serif mode, and in additional modes if necessary to show the unique variations for that code page.

Table 2–4. Print Modes Supported

Character Set	NLQ (Serif)	DP	Draft	Notes
0437 PC Character Set	X	X	X	
0813 Greek	X	X	X	Limited character set support for most CPI settings in Draft mode
0819 ISO/ANSI Multilingual	X	X	X	
0850 PC Multilingual	X	X	X	Variant character set for NLQ Sans Serif.
0851 Greek Old	X	X	X	
0852 Latin 2/Roece	X	X	X	
0853 Latin 3 PC	X	X	X	
0855 Cyrillic	X	X	X	Limited character set support for most CPI settings in Draft mode
0857 Turkish	X	X	X	
0860 Portuguese	X	X	X	

(continued next page)

Table 2–4. Print Modes Supported *(continued)*

Character Set	NLQ (Serif)	DP	Draft	Notes
0861 Icelandic	X	X	X	
0862 Hebrew	X	X	X	
0863 Canadian French	X	X	X	
0864 Arabic	X	X	X	Limited character set support for most CPI settings in Draft mode. Variant character set for NLQ Sans Serif.
0865 Danish/Norwegian	X	X	X	
0866 Russian Cyrillic 996	X	X	X	Limited character set support for most CPI settings in Draft mode
0869 Greek New	X	X	X	
0874 Thai	X	X	X	Limited character set support for most CPI settings in Draft mode. Variant character set for NLQ Sans Serif.
0876 OCR A	N/A	N/A	N/A	10 CPI OCR only
0877 OCR B	N/A	N/A	N/A	10 CPI OCR only
0912 ISO Latin 2 PC	X	X	X	
0915 ISO Cyrillic PC	X	X	X	Limited character set support for most CPI settings in Draft mode
1046 Arabic Extended	X	X	X	Limited character set support for most CPI settings in Draft mode. Variant character set for NLQ Sans Serif.
1098 Farsi 1285 (PC)	X	X	X	Limited character set support for most CPI settings in Draft mode. Variant character set for NLQ Sans Serif.

The Control Codes

This index lists each printer command by function, ASCII mnemonic, and the page where the command is explained in detail. "N/A" means not applicable. The rest of this chapter defines the control code functions for Proprinter III XL emulation mode. The commands are listed in alphabetical order.

† = Produces non–Proprinter behavior in your printer.

FUNCTION	ASCII CODE	PAGE
Selection of Character Set		
Character Set Select: Set 1 (A)	ESC 7	2–27
Character Set Select: Set 2 (B)	ESC 6	2–27
Print Quality		
† Bold Printing	ESC G	2–23
Bold Printing Cancel	ESC H	2–24
† Character Pitch 12 cpi	ESC :	2–26
† Condensed Print	SI	2–28
Condensed Print Cancel	DC2	2–29
† Double Wide Print	ESC W *n*	2–31
† Double Wide Print (One Line Only)	SO	2–33
Double Wide Print (One Line Only) Cancel	DC4	2–34
† Emphasized Print	ESC E	2–35
Emphasized Print Cancel	ESC F	2–36
† Overscoring	ESC _ *n*	2–51
† Print Mode	ESC I *n*	2–53
† Print Quality	ESC x	2–54
† Proportional Spacing	ESC P	2–54
† Select Attributes	ESC [@	2–56
† Superscript/Subscript Printing	ESC S *n*	2–58
Superscript/Subscript Printing Cancel	ESC T	2–59
† Underline	ESC - *n*	2–65
Bit Image		
Bit Image, Single Density (Normal Speed)	ESC K *n1 n2*	2–19
Bit Image, Double Density (Half Speed)	ESC L *n1 n2*	2–20
Bit Image, Double Density, (Normal Speed)	ESC Y *n1 n2*	2–21
Bit Image, Quadruple Density (Half Speed)	ESC Z *n1 n2*	2–22
Other Functions		
Bell	BEL	2–18
Deselect Printer	ESC Q *n*	2–30
Escape Sequence	ESC	2–9
Initialize Parameters	ESC [K	2–39
Print All Characters	ESC \	2–52
Print Next Character	ESC ^	2–52
Unidirectional Printing	ESC U *n*	2–66

Backspace

ASCII Code BS

Hex Code 08

Dec Code 08

Purpose Moves the logical print head to the left one character space toward the first character column.

Discussion BS moves the character position indicator (the logical print head position) one character space to the left at the current character pitch setting. This code is ignored if the logical print head is positioned at the first character column.

When the backspace code is received, printing speed will be reduced. If the printer is in double width mode, the backspace code moves the print head left two normal character spaces.

† When a single backspace control code follows one of the Bit Image Graphics commands (ESC K, ESC L, ESC Y, ESC Z), IBM 6400 printers backspace to the last character position at the end of the graphics data printout. The IBM Proprinter backspaces to the beginning of the line, at the beginning of the graphics data.

† After a backspace, IBM 6400 printers will overstrike a character preceded by a control code (such as bold or proportional) with a partially or incorrectly formed letter. The IBM Proprinter overstrikes properly in this situation.

Example Print and backspace two character positions.

```
10 LPRINT "TTTTT";
20 LPRINT CHR$(8);CHR$(8);
30 LPRINT "=="


TTT==
```

Bell

ASCII Code BEL

Hex Code 07

Dec Code 07

Purpose Sounds a buzzer/beeper.

Discussion The BEL function will sound the buzzer/beeper for 0.2 seconds upon receipt of this command.

Example The following line will sound the printer buzzer:

```
10 LPRINT CHR$(7);
```

Bit Image Mode, Single Density (Normal Speed)

ASCII Code ESC K *n1 n2*

Hex Code 1B 4B

Dec Code 27 75 *n1 n2*

Expression CHR$(27);"K";CHR$(*n1*);CHR$(*n2*);"DATA"

Purpose Selects single (normal) density bit image graphics.

where: *n1* + 256*n2* defines the number of data bytes to follow.
DATA = ASCII characters for the dot pattern bytes.

NOTE: The DATA can be expressed in a CHR$(DATA) format with the appropriate decimal values of the ASCII characters supplied, especially in cases where the dot patterns of nonprintable characters are required.

Discussion This code prints specified data as bit image graphics at normal density, 60 dots per inch horizontally and 72 dots per inch vertically. For more information, see page 2–10, "Overview of Graphics Control Codes" and page 5–2, "Bit Image Graphics."

Example The following example produces a pattern of Single Density Bit Image graphics. The 9-byte bit pattern is repeated 27 times. Compare this example to the double density and quadruple density examples.

```
10 WIDTH "lpt1:",255
20 LPRINT "Single Density Bit Image Graphics"
30 LPRINT CHR$(27);"K";CHR$(244);CHR$(0);
40 FOR N=1 TO 27
50 RESTORE
60 FOR I=1 TO 9
70 READ R
80 LPRINT CHR$(R);
90 NEXT I
100 NEXT N
110 LPRINT CHR$(255)
120 DATA 255,128,64,32,16,8,4,2,1
```

```
Single Density Bit Image Graphics
```

Bit Image Mode, Double Density (Half Speed)

ASCII Code ESC L *n1 n2*

Hex Code 1B 4C

Dec Code 27 76 *n1 n2*

Expression CHR$(27);″L″;CHR$(*n1*);CHR$(*n2*);″DATA″

Purpose Selects double density bit image graphics.

where: *n1* + 256*n2* defines the number of data bytes to follow.
DATA = ASCII characters for the dot pattern bytes.

NOTE: The DATA can be expressed in a CHR$(DATA) format with the appropriate decimal values of the ASCII characters supplied, especially in cases where the dot patterns of nonprintable characters are required.

Discussion This code prints specified data as bit image graphics at double horizontal density, 120 dots per inch horizontally and 72 dots per inch vertically. This code causes print speed to be reduced by half from normal density speed. For more information, see page 2–10, “Overview of Graphics Control Codes” and page 5–2, “Bit Image Graphics.”

Example The following example produces Double Density Bit Image graphics of the pattern used in the Single Density Bit Image Mode example. Note that the amount of data must be doubled in order to produce this pattern for double density (the data is used 54 times rather than 27).

```
10 WIDTH "lpt1:",255
20 LPRINT "Double Density Bit Image Graphics"
30 LPRINT CHR$(27);"L";CHR$(231);CHR$(1);
40 FOR N=1 TO 54
50 RESTORE
60 FOR I=1 TO 9
70 READ R
80 LPRINT CHR$(R);
90 NEXT I
100 NEXT N
110 LPRINT CHR$(255)
120 DATA 255,128,64,32,16,8,4,2,1
```

```
Double Density Bit Image Graphics
```

Bit Image Mode, Double Density (Normal Speed)

ASCII Code ESC Y *n1 n2*

Hex Code 1B 59

Dec Code 27 89 *n1 n2*

Expression CHR$(27);″Y″;CHR$(*n1*);CHR$(*n2*);″DATA″

Purpose Selects double density bit image graphics at single density speed.

where: *n1* + 256*n2* defines the number of data bytes to follow.
DATA = ASCII characters for the dot pattern bytes.

NOTE: The DATA can be expressed in a CHR$(DATA) format with the appropriate decimal values of the ASCII characters supplied, especially in cases where the dot patterns of nonprintable characters are required.

Discussion This code prints specified data as bit image graphics at double horizontal density, 120 dots per inch horizontally and 72 dots per inch vertically. By ignoring adjacent dots, the print speed is not reduced from the normal density speed. For more information, see page 2–10, “Overview of Graphics Control Codes” and page 5–2, “Bit Image Graphics.”

Example The following example produces a Double Density Normal Speed Bit Image graphics for the same pattern as in the Normal (Single) Density example. Note that the amount of data must be doubled for double density (the data is used 54 times rather than 27).

```
10 WIDTH "lpt1:",255
20 LPRINT "Double Density Double Speed Bit Image Graphics"
30 LPRINT CHR$(27);"Y";CHR$(231);CHR$(1);
40 FOR N=1 TO 54
50 RESTORE
60 FOR I=1 TO 9
70 READ R
80 LPRINT CHR$(R);
90 NEXT I
100 NEXT N
110 LPRINT CHR$(255)
120 DATA 255,128,64,32,16,8,4,2,1
```

```
Double Density Double Speed Bit Image Graphics
```

Bit Image Mode, Quadruple Density (Half Speed)

ASCII Code ESC Z *n1 n2*

Hex Code 1B 5A *n1 n2*

Dec Code 27 90 *n1 n2*

Expression CHR$(27);"Z";CHR$(*n1*);CHR$(*n2*);"DATA"

Purpose Selects quadruple density bit image graphics.

where: *n1* + 256*n2* defines the number of data bytes to follow.
DATA = ASCII characters for the dot pattern bytes.

NOTE: The DATA can be expressed in a CHR$(DATA) format with the appropriate decimal values of the ASCII characters supplied, especially in cases where the dot patterns of nonprintable characters are required.

Discussion This code prints specified data as bit image graphics at quadruple density, 240 dots per inch horizontally and 72 dots per inch vertically. This code causes print speed to be reduced by half. For more information, see page 2–10, "Overview of Graphics Control Codes" and page 5–2, "Bit Image Graphics."

Example The following example produces quadruple density graphics of the pattern used in the Single Density Bit Image Mode example. Note that the amount of data must be quadrupled for quadruple density (the data is used 108 times rather than 27).

```
10 WIDTH "lpt1:",255
20 LPRINT "Quad Density Bit Image Graphics"
30 LPRINT CHR$(27);"Z";CHR$(205);CHR$(3);
40 FOR N=1 TO 108
50 RESTORE
60 FOR I=1 TO 9
70 READ R
80 LPRINT CHR$(R);
90 NEXT I
100 NEXT N
110 LPRINT CHR$(255)
120 DATA 255,128,64,32,16,8,4,2,1
```

```
Quad Density Bit Image Graphics
```

Bold Printing

ASCII Code ESC G

Hex Code 1B 47

Dec Code 27 71

Purpose Selects bold character printing.

Discussion When this command is received, all characters are printed in bold until reset by the Bold Print Reset control code or printer reset. The bold print attribute is implemented by increasing the dot density for the bolded text (with a similar result to double strike printing).

NOTE: The ESC E (page 2–35) and ESC G commands are equivalent; they produce the same print effect.

† IBM 6400 printers print both Bold and Condensed when this control code is combined with Condensed (SI). The IBM Proprinter prints only Emphasized when control codes for Compressed and Emphasized are combined. (See Table 2–3 on page 2–6.)

Example The following sample program illustrates bold character printing.

```
10 LPRINT "Control code ESC G"
20 LPRINT CHR$(27);"G";
30 LPRINT "selects bold character printing,"
40 LPRINT "for example: AaBbCcDdEeFfGgHhIiJjKkLlMmNnOoPp."
50 LPRINT "Control code ESC H"
60 LPRINT CHR$(27);"H";
70 LPRINT "cancels bold character printing."
```

```
Control code ESC G
selects bold character printing,
for example: AaBbCcDdEeFfGgHhIiJjKkLlMmNnOoPp.
Control code ESC H
cancels bold character printing.
```

Bold Printing, Cancel

ASCII Code ESC H

Hex Code 1B 48

Dec Code 27 72

Purpose Cancels bold printing.

Discussion No other print attributes are changed.

Cancel

ASCII Code CAN

Hex Code 18

Dec Code 24

Purpose Clears the print buffer of all symbols since the last paper motion command was received.

Discussion The CAN command cancels all characters sent to the printer after the last paper motion command.

This command will cancel the double wide attribute if set by SO. No other print attributes are affected.

Carriage Return

ASCII Code CR

Hex Code 0D

Dec Code 13

Purpose Returns the logical print head to the first character column (resets the pointer to the first character position). May be configured to include a line feed.

Discussion The CR code is configured via the ESC 5 code (this page) or via the operator panel menus (described in Chapter 4 of the *Setup Guides*). The CR = CR configuration causes the character position indicator to be positioned at character column one; subsequent printable data preceding a paper motion command overstrikes previously printed data. The CR = CR + LF configuration causes the CR code to perform a carriage return plus a line feed.

The CR code also cancels expanded (double wide) print when set by code SO (single line printing attribute).

Carriage Return Set

ASCII Code ESC 5 *n*

Hex Code 1B 35 *n*

Dec Code 27 53 *n*

Purpose Defines the result from the Carriage Return (CR) code.

where: *n* may range from 0 to 255 –
If *n* = 0, 2, 4 ... (any even value), then CR = CR (the default).
If *n* = 1, 3, 5 ... (any odd value), then CR = CR + LF.

Discussion This command overrides the configuration menu setting.

- CR = CR (default) configuration causes the character position indicator to be positioned at character column one. Subsequent printable data preceding a paper motion command overstrikes previous printable data.
- CR = CR + LF configuration causes the CR code to perform a carriage return plus a line feed.

Character Pitch 12 cpi

ASCII Code ESC :

Hex Code 1B 3A

Dec Code 27 58

Purpose Sets character pitch to 12 cpi.

Discussion An ESC: code overrides any operator panel setting.

† When this control code is combined with Condensed (SI) and NLQ Serif/Non Serif (via ESC I or ESC x), IBM 6400 printers print 17.16 cpi plus NLQ (Serif/Non Serif). The IBM Proprinter prints at 20 cpi (without NLQ) when the same print attributes are combined (see Table 2–3 on page 2–6).

Character Set Select: Set 1 (A)

ASCII Code ESC 7

Hex Code 1B 37

Dec Code 27 55

Purpose Selects hex codes 80 to 9F in the character sets as control codes. Cancels the command ESC 6.

Discussion This control code overrides the operator panel setting (described in Chapter 4 of the *Setup Guide*).

Character Set Select: Set 2 (B)

ASCII Code ESC 6

Hex Code 1B 36

Dec Code 27 54

Purpose Selects hex codes 80 to 9F in the character sets as printable symbols. Cancels the command ESC 7.

Discussion This control code overrides the operator panel setting (described in Chapter 4 of the *Setup Guide*). Appendix D shows the printable symbols for hex codes 80 to 9F.

Condensed Print

ASCII Code	SI	ESC SI
Hex Code	0F	1B 0F
Dec Code	15	27 15

Purpose Sets condensed print.

Discussion You may enable or disable the condensed print feature using the operator panel (the default setting for the Condensed Print option is enabled, as described in Chapter 4 of the *Setup Guide).* Once condensed print is enabled, this control code sets condensed print until it is canceled by control code DC2, a printer reset, or a new print mode (ESC I) control code.

The manner in which the print is condensed varies depending on the initial print size. Several examples follow:

	Initial Print Size	Condenses To
	5 cpi	8.55 cpi
	6 cpi	10 cpi
	8.58 cpi	no change
	10 cpi	17.16 cpi
	12 cpi (except NLQ)	20 cpi
†	12 cpi NLQ	17.16 cpi
	17.16 cpi	no change
	20 cpi	no change

† IBM 6400 printers print both Condensed and Bold when this control code is combined with Bold (ESC E or ESC G). The IBM Proprinter prints *only* Emphasized if control codes for Compressed and Emphasized are combined. (See Table 2–3 on page 2–6.)

Double–high characters combined with Condensed will print as double–high *only.*

Example The following sample program shows condensed character printing and reset.

```
10 LPRINT "Control code"
20 LPRINT "SI selects"
30 LPRINT CHR$(15);
40 LPRINT "condensed character printing."
50 LPRINT "Control code DC2"
60 LPRINT CHR$(18);
70 LPRINT "resets condensed character printing."
```

```
Control code
SI selects
condensed character printing.
Control code DC2
resets condensed character printing.
```

Condensed Print Cancel

ASCII Code	DC2	ESC DC2
Hex Code	12	1B 12
Dec Code	18	27 18

Purpose Cancels condensed character printing and sets pitch to 10 cpi.

Discussion The Condensed Print Cancel command sets the character pitch to 10 cpi, or 5 cpi if printing is set for double wide.

Example See the SI control code (page 2–28) for an example of Condensed Print Cancel.

Deselect Printer

ASCII Code ESC Q 22

Hex Code 1B 51 16

Dec Code 27 81 *22*

Expression LPRINT CHR$(27);CHR$(81);CHR$(22);

Purpose Stops the printer from processing data received from the host computer.

Discussion This code is for diagnostic use; it instructs the printer to stop processing data received from the host system. In order to resume processing data, the printer must be reset from the host system.

Example Using the BASIC language, you may deselect the Proprinter III XL with the following:

```
LPRINT CHR$(27);CHR$(81);CHR$(22);
```

Double Wide Print

ASCII Code ESC W *n*

Hex Code 1B 57 *n*

Dec Code 27 87 *n*

Purpose Selects or cancels double wide (expanded) print.

where: n may range from 0 to 255 –
If *n* = 1, 3, 5 ... (any odd value), double wide print is selected.
If *n* = 0, 2, 4 ... (any even value), double wide print is cancelled.

Discussion An ESC W code sets or cancels double wide print, as follows:

When expanded print using ESC W is received, all characters print double wide until cancelled by an even parameter hex code.

Double wide print can also be set via the command SO and ESC SO, double wide print for one line only. An ESC W code overrides these settings.

The manner in which the print is expanded varies depending on the initial print size. Several examples follow:

Initial Print Size	Expands to
5 cpi	no change
6 cpi	no change
8.58 cpi	no change
10 cpi	5 cpi
12 cpi	6 cpi
17.16 cpi	8.55 cpi
20 cpi	10 cpi

† IBM 6400 printers print both Double-Wide and NLQ Serif when this control code is combined with NLQ Serif (via ESC I). The IBM Proprinter prints Double-Wide plus NLQ Sans Serif if control codes for Double–Wide and NLQ Serif are combined. (See Table 2–3 on page 2–6.)

Example The following sample program illustrates expanded character printing and expanded character printing reset.

```
10 LPRINT "Control code"
20 LPRINT "ESC W 1 selects"
30 LPRINT CHR$(27);"W";CHR$(1);
40 LPRINT "expanded character printing."
50 LPRINT "Control code"
60 LPRINT "ESC W 0 resets"
70 LPRINT CHR$(27);"W";CHR$(0);
80 LPRINT "expanded character printing."
```

```
Control code
ESC W 1 selects
e x p a n d e d   c h a r a c t e r   p r i n t i n g .
Control code
ESC W 0 resets
expanded character printing.
```

Double Wide Print (One Line Only)

ASCII Code	SO	ESC SO
Hex Code	0E	1B 0E
Dec Code	14	27 14

Purpose Selects double wide print for one line only.

Discussion This expanded print command is a line-by-line print attribute; when the SO or ESC SO command is received, the current line will be printed double wide and automatically reset. This command can be reset by a paper motion command (FF, LF, VT, CR), by the DC4 (double wide cancel) code, CAN or ESC W (double wide print).

See the previous control code (ESC W) for examples of print expansion for various initial print sizes.

† IBM 6400 printers print both Double-Wide and NLQ Serif when this control code is combined with NLQ Serif (via ESC I). An IBM Proprinter prints Double-Wide plus NLQ Sans Serif if control codes for Double–Wide and NLQ Serif are combined. (See Table 2–3 on page 2–6.)

Example The following sample program illustrates Expanded Print for one line only.

```
10 LPRINT "Control code"
20 LPRINT "SO selects"
30 LPRINT CHR$(14);
40 LPRINT "expanded character printing"
50 LPRINT "for one line only."
```

```
Control code
SO selects
expanded character printing
for one line only.
```

Double Wide Print (One Line Only)Cancel

ASCII Code	DC4	ESC DC4
Hex Code	14	1B 14
Dec Code	20	27 20

Purpose Cancels double wide print, if it was set by command SO.

Discussion The DC4 code cancels Double Wide Print command SO. If Double Wide Print is not enabled, the DC4 code is ignored. A DC4 code can occur at any place in the datastream and is acted upon immediately.

Emphasized Print

ASCII Code ESC E

Hex Code 1B 45

Dec Code 27 69

Purpose Selects emphasized character print format.

Discussion When the emphasized print command is received, all characters will be printed in emphasized (bold) print until reset by the Emphasized Print Reset command or printer reset. Emphasized print reduces the current print speed.

NOTE: The ESC G (page 2–23) and ESC E commands are equivalent; they produce the same print effect.

† IBM 6400 printers print both Condensed and Emphasized when this control code is combined with Condensed (SI). An IBM Proprinter prints *only* Emphasized when control codes for Compressed and Emphasized are combined. (See Table 2–3 on page 2–6.)

Example The following sample program illustrates emphasized character printing.

```
10 LPRINT "Control code"
20 LPRINT "ESC E selects"
30 LPRINT CHR$(27);"E";
40 LPRINT "emphasized character printing."
42 LPRINT "Control code ESC F"
50 LPRINT CHR$(27);"F";
60 LPRINT "cancels emphasized character printing."
```

```
Control code
ESC E selects
emphasized character printing.
Control code ESC F
cancels emphasized character printing.
```

Emphasized Print Cancel

ASCII Code ESC F

Hex Code 1B 46

Dec Code 27 70

Purpose Cancels emphasized character printing.

Discussion The emphasized print reset command only resets the emphasized print character attribute. See Example for using ESC E combined with ESC F.

Form Feed

ASCII Code FF

Hex Code 0C

Dec Code 12

Purpose Prints the data in the buffer, advances the paper to the next top-of-form, and moves the logical printhead to the first character column.

Discussion Forms length is set by using the operator panel or forms length control codes. This code cancels double wide (expanded) characters if set by the SO command.

The Form Feed command will react differently when the VFU is active. Refer to Chapter 8 in this manual for further information.

Forms Length Set in Inches

ASCII Code ESC C 0 *n*

Hex Code 1B 43 00 *n*

Dec Code 27 67 0 *n*

Purpose Sets the length of forms (paper) in inches.

where: *n* = whole numbers (hex value) from 1 to 24 to specify the number of inches on a page. (All larger values are ignored.)

Discussion Upon receipt of this code, the current line becomes the first line of the form, and the forms length set becomes the current forms length. Vertical tab positions set below the bottom of the form are ignored; in addition, once a new forms length is set the bottom margin is set to zero.

Line spacing changes do not affect the result of this command. If the forms length is set smaller than the line spacing, a form feed advances the paper position to the next top-of-form position.

Forms length in inches can also be set at the operator panel via the Print Format menu (refer to Chapter 4 of the *Setup Guide*). However, this host control code overrides the operator panel setting.

Forms Length Set in Lines

ASCII Code ESC C *n*

Hex Code 1B 43 *n*

Dec Code 27 67 *n*

Purpose Sets the length of a form (paper) in lines.

where: *n* = 1 to 192 (1 to C0 hex) to specify the number of lines per page at the current line spacing.

Discussion The forms length is defined in inches as the quotient of *n* divided by the current lines per inch (lpi) setting. Once the forms length has been set, subsequent line spacing changes do not affect the result of this command.

If the forms length is set smaller than the line spacing, a form feed advances the paper position to the next top-of-form.

If the forms length derived from the quotient of *n* lines divided by lines per inch is *not* an exact multiple of the printer dot resolution, the value is adjusted down until the forms length and dot resolution distance match.

Forms length in lines can also be set at the operator panel via the Print Format menu (refer to Chapter 4 of the *Setup Guide*). However, this host control code overrides the operator panel setting.

Initialize Parameters

ASCII Code ESC [K *n1* 0 *n2 n3 n4 n5*

Hex Code 1B 5B 4B *n1* 00 *n2 n3 n4 n5*

Dec Code 27 91 75 *n1* 00 *n2 n3 n4 n5*

Purpose Sets the printer's initial condition.

Discussion This command causes the printer to reset and defines the configuration that will be loaded to the printer during the reset. Several variables must be specified to define the load configuration, as described below.

WARNING: An `ESC [K` code can occur at any place in the datastream and is acted upon immediately. All numerical parameters are in the 00 to FF hex range unless stated otherwise. Only specified parameters are supported. Other values may be ignored or cause unpredictable results, and should be avoided.

n1

The value of *n1* defines which of the following *n* bytes will be included in the command line, as shown in the table below:

n1 **Hex Value**	**Function**
1	One byte follows (n2)
3	Three bytes follow (n2, n3, and n4)
4	Four bytes follow (n2, n3, n4, and n5)

WARNING: Specifying any value for *n1* other than 1, 3, or 4 may cause unpredictable results, and should be avoided.

n2

The 2–digit hexadecimal value for *n2* defines the load configuration for the printer. The Proprinter III XL supports six hexadecimal values for this parameter: 00, 01, 04, 05, 254, and 255. The following table describes the different load configurations that will result with each value:

Table 2–1. Load Configurations defined via ESC[K Command

n2 **Hex Value**	**Function**
00, 01, 254	The printer will load the power–up configuration that is stored in memory. Configuration changes that are defined by command bytes *n4* and n5, if present, will override conflicting values stored in memory.
04, 05, 255	The printer will load the factory default configuration. Configuration parameters defined by command bytes *n4* and *n5*, if present, will override conflicting factory default values.

n3

Parameter *n3* is provided for compatibility with the Proprinter III XL printer control language standard. You may define any value for this parameter for use with the IBM 6400 printers. (For Proprinters, this bit must define the attached printer as either Proprinter III, value 03, or Proprinter III XL, hex value 16.)

n4 and *n5*

Parameter bytes *n4* and *n5* allow you to define several configuration parameters that will override conflicting factory default and NVRAM-based configuration values when the printer is reinitialized. Depending on the value that is defined for *n2* (refer to Table 2–1), these values may also be saved to memory.

NOTE: In addition to the formatting from bytes *n4* and n5, this command sets the current line as top-of-form. It also clears vertical tabs and sets the horizontal tabs at every eight columns, starting at column 9.

n4 Bit	Function	OFF (0)	ON (1)
7	Process this byte.	Process	Ignore
6	Reserved	Reserved	Reserved
5	N/A	————	————
4	Line Feed =	LF	LF + CR (add CR with each LF)
3	Carriage Return =	CR	CR + LF (add LF with each CR)
2	Set forms length	11”	12”
1	Slashed zero	Disable	Enable
0	Character set	1 (A)	2 (B)

n5 Bit	Function	OFF (0)	ON (1)
7	Process this byte.	Process	Ignore
6	Code page	437	850
5	Unidirectional printing	bidirectional	unidirectional
4	12 cpi compressed to 20	20	12
3	n/a	——	——
2	Form feed at TOF	Enable	Ignore
1	Print width	13.6 inch	8 inch
0	Sheet feeder	N/A	N/A

Line Feed

ASCII Code LF

Hex Code 0A

Dec Code 10

Purpose Prints the data in the buffer (if any) and advances the paper one line at the current line space setting.

Discussion If configured for LF equals new line (LF = CR + LF), the logical print head is positioned at character column 1 of the new line. Otherwise, the logical print head does not move when configured for LF function only (LF = LF only). The LF function cancels double wide (expanded) characters if set by the SO command.

Line feed can occur at any place in the datastream and is acted upon immediately.

Line Feed *n*/216 Inch (One Line Only)

ASCII Code ESC J *n*

Hex Code 1B 4A *n*

Dec Code 27 74 *n*

Purpose Advances the vertical character position *n*/216 inch for one line only.

where: *n* = 1 to 255

Discussion The *n*/216–inch line feed control code is effective for one line only. All single–line–only print attributes are canceled.

If the emulation is configured for LF equals newline (LF=CR+LF), the paper advances one line at the current line space setting and the logical print head is positioned at character column 1.

The paper position moves only in multiples of the current dot row spacing. If the distance to move is other than a multiple of the current dot row spacing, the remainder is added to the next paper motion command.

Small values of *n* may result in overlapping lines. Overlapping lines may also occur if print attributes such as Elongated (Double High), Superscript, or Subscript characters are used on the same line. Printing at different horizontal and vertical densities will not overlap.

Example The following example illustrates *n*/216-inch line spacing.

```
10 LPRINT "Control code ESC J 200
20 LPRINT CHR$(27);"J";CHR$(200);
30 LPRINT "performs a 200/216 inch"
40 LPRINT "line feed function for one line only."
```

```
Control code ESC J 200
```

```
performs a 200/216 inch
line feed function for one line only.
```

Line Spacing 1/8 Inch (8 lpi)

ASCII Code ESC 0

Hex Code 1B 30

Dec Code 27 48

Purpose Specifies continuous line spacing at 1/8-inch increments (8 lpi).

Discussion When the 1/8-inch line spacing control code is received, all lines will be printed at 8 lpi until a new line spacing is selected or power is reset.

Example The following example illustrates 1/8-inch line spacing.

```
10 LPRINT "Control code ESC 0 sets"
20 LPRINT CHR$(27);"0";
30 LPRINT "line spacing at"
40 LPRINT "1/8 (8 lpi) inch for all subsequent lines"
50 LPRINT "until reset or another spacing is selected."
```

```
Control code ESC 0 sets
line spacing at
1/8 (8 lpi) inch for all subsequent lines
until reset or another spacing is selected.
```

Line Spacing 7/72 Inch (10.3 lpi)

ASCII Code ESC 1

Hex Code 1B 31

Dec Code 27 49

Purpose Specifies the line spacing at 7/72-inch (10.3 lpi) increments.

Discussion When the 7/72–inch line spacing control code is received, all lines will be printed at the 7/72–inch line spacing until a new line spacing is selected or power is reset. The control code line spacing selection will override the operator panel line spacing setting, and the message display will reflect the line spacing as 10.3 lines per inch.

Caution should be used when combining this control code with other print attributes such as Elongated (Double High), Superscript, or Subscript; overlapping lines may occur.

Example The following example illustrates 7/72-inch line spacing.

```
10 LPRINT "Control code ESC 1 sets"
20 LPRINT CHR$(27);"1";
30 LPRINT "line spacing at"
40 LPRINT "7/72 inch for all subsequent lines"
50 LPRINT "until reset or another spacing is selected."
```

```
Control code ESC 1 sets
line spacing at
7/72 inch for all subsequent lines
until reset or another spacing is selected.
```

Line Spacing *n*/72 Inch (Executes)

ASCII Code ESC 2

Hex Code 1B 32

Dec Code 27 50

Purpose ESC 2 sets line spacing to 6 lpi or as set by ESC A.

Discussion ESC 2 asserts *n*/72–inch line spacing as set by ESC A (page 2–47). If no distance has been set by ESC A, the distance is 1/6 inch.

The control code line spacing selection will override the operator panel line spacing setting.

Example The following example illustrates 1/6-inch line spacing and assumes that a distance has not been set by ESC A.

```
10 LPRINT "Control code ESC 2 sets"
20 LPRINT CHR$(27);"2";
30 LPRINT "line spacing at"
40 LPRINT "6 lpi for all subsequent lines"
50 LPRINT "until reset or another spacing is selected."
```

```
Control code ESC 2 sets
line spacing at
6 lpi for all subsequent lines
until reset or another spacing is selected.
```

Line Spacing *n*/72 Inch (Storage)

ASCII Code ESC A *n*

Hex Code 1B 41 *n*

Dec Code 27 65 *n*

Purpose Stores a line spacing of *n*/72-inch increments.

where: *n* = 1 to 255 (all others are ignored)

Discussion This control code stores a value for line spacing of *n*/72 inch. The ESC 2 control code (described on page 2–46) executes the line spacing stored by the preceding ESC A, until a new line spacing is selected or power to the printer is reset. A control code line spacing overrides an operator panel line spacing setting. (The operator panel display shows line spacing in lines per inch.)

Small values of *n* may result in overlapping lines. Overlapping lines may also occur if print attributes such as Elongated (Double High), Superscript, or Subscript characters are used on the same line. Common values of *n* follow:

n	Line Spacing
24	3 lpi
18	4 lpi
12	6 lpi
9	8 lpi
8	9 lpi
6	12 lpi

Example The following example illustrates 20/72-inch line spacing.

```
10 LPRINT "Control code ESC A 20 sets"
20 LPRINT CHR$(27);"A";CHR$(20);CHR$(27);"2";
30 LPRINT "line spacing at 20/72 inch"
40 LPRINT "increments for all subsequent lines"
50 LPRINT "until reset or another spacing is selected."
```

```
Control code ESC A 20 sets
line spacing at 20/72 inch

increments for all subsequent lines

until reset or another spacing is selected.
```

Line Spacing *n*/216 Inch

ASCII Code ESC 3 *n*

Hex Code 1B 33 *n*

Dec Code 27 51 *n*

Purpose Specifies the line spacing at n/216–inch increments.

where: *n* = 1 to 255

Discussion When the *n*/216–inch line spacing control code is received, all line feeds following will be at *n*/216–inch line spacing until a new line spacing is selected or power is reset. The control code line spacing selection will override the control panel line spacing setting.

The vertical character position moves only in multiples of the current dot row spacing. If the distance to move is other than a multiple of the current dot row spacing, the remainder is added to the next paper motion command.

Caution should be used when combining this control code with other print attributes such as Elongated (Double High), Superscript, or Subscript; overlapping lines may occur.

Example The following example illustrates *n*/216-inch line spacing.

```
10 LPRINT "Control code ESC 3 50 sets"
20 LPRINT CHR$(27);"3";CHR$(50);
30 LPRINT "line spacing at 50/216 inch"
40 LPRINT "increments for all subsequent lines"
50 LPRINT "until reset or another spacing is selected."
```

```
Control code ESC 3 50 sets
line spacing at 50/216 inch
increments for all subsequent lines
until reset or another spacing is selected.
```

Margin, Bottom

ASCII Code ESC N *n*

Hex Code 1B 4E *n*

Dec Code 27 78 *n*

Purpose Sets the bottom margin.

Discussion *n* defines the number of lines above the bottom of the form to set as the bottom margin. *n* has a range from 1 through 255. The actual margin in inches is the quotient of *n* divided by the current lines per inch (lpi).

If a line feed command causes the active position to advance below the bottom margin, the paper advances to the top of the next form. If the bottom margin is set equal to or greater than the form length, printing is only allowed on the top line of each page. If the forms length is changed by the ESC C code (Forms Length sequence), the bottom margin is set to zero.

The bottom margin setting can also be selected from the operator panel; however, the host control code will override the operator panel setting.

Any vertical tabs set within the bottom margin zone will be ignored.

Margin Cancel, Bottom

ASCII Code ESC O

Hex Code 1B 4F

Dec Code 27 79

Purpose Resets the bottom margin to zero.

Margins, Horizontal

ASCII Code ESC X *n m*

Hex Code 1B 58 *n m*

Dec Code 27 88

Purpose Sets left and right margins in character positions.

where: *n* = left margin position
m = right margin position

Discussion The values of *n* and *m* must be in the range from 0 to 255. The margins are measured in character positions at the current characters per inch (cpi).

The value set for *n* is the left margin, where *n* is the number of character positions from the left edge of the paper. The left margin in inches is the quotient of the value for *n* divided by the current cpi. Once the left margin is set, later changes in the cpi do not affect the margin setting.

The value set for *m* is the right margin, where *m* is the number of character positions from the left edge of the paper. The right margin in inches is the quotient of the value for *m* divided by the current cpi. Once the right margin is set, later changes in the cpi do not affect the margin setting.

Overscoring

ASCII Code ESC _ *n*

Hex Code 1B 5F *n*

Dec Code 27 95 *n*

Purpose Enables or disables automatic overscoring of all characters.

where: *n* may range from 0 to 255 –
n = 00, 02, 04...disables automatic overscoring
n = 01, 03, 05...enables (any odd value from hex 01 to hex FF)

Discussion When automatic overscore is enabled, all characters, including spaces, are overscored. Full–height graphics characters are not overscored. (Full–height characters are in the upper ASCII character set for code pages 437 and 850, in positions 176–233, or 244.)

Example The following sample program illustrates automatic overscoring and overscoring reset.

```
10 LPRINT "Control code ESC _ 1"
20 LPRINT CHR$(27);"_";CHR$(1);
30 LPRINT "enables automatic overscoring."
40 LPRINT "Control code ESC _ 0"
50 LPRINT CHR$(27);"_";CHR$(0);
60 LPRINT "disables automatic overscoring."
```

```
Control code ESC _ 1
enables automatic overscoring.
Control code ESC _ 0
disables automatic overscoring.
```

Print All Characters

ASCII Code ESC \ *n1 n2*

Hex Code 1B 5C *n1 n2*

Dec Code 27 92 *n1 n2*

Purpose Prints the characters assigned to code points as characters, rather than interpreting the code values as commands.

where: *n1* + 256*n2* defines the number of data bytes to follow.

Discussion The number of data bytes specified by *n1* + 256*n2* will print as text. Valid numerical parameters are in the range hex 00 to hex FF. Data values that do not correspond to standard ASCII codes will print as spaces.

Print Next Character

ASCII Code ESC ^ *n*

Hex Code 1B 5E *n*

Dec Code 27 94 *n*

Purpose Prints the graphic character assigned to *n*, rather than interpreting the code value as a command.

Discussion This command may appear anywhere in the data stream, and will be acted upon immediately. Valid numerical parameters are in the range hex 00 to hex FF.

Print Mode

ASCII Code ESC I *n*

Hex Code 1B 49 *n*

Dec Code 27 73 *n*

Purpose Selects a print mode.

Discussion This control code selects a print mode from among the following choices:

n Hex	Function
X0	DP
X1	Draft 12 CPI
X2	NLQ Sans Serif
X3	NLQ Serif
X4	DP
X5	Draft 12 CPI
X6	NLQ Sans Serif
X7	NLQ Serif
XB	NLQ Serif–Italic–Proportional
XF	NLQ Serif–Italic

There are several duplicate Hex values that select the same print quality. These are provided for compatibility with the Proprinter III XL standard.

† IBM 6400 printers print at 17.16 cpi when NLQ (Serif or Sans Serif) is combined with Condensed (SI) and 12 CPI (ESC :). The IBM Proprinter prints at 20 cpi when any NLQ is combined with Condensed and 12 CPI. (See Table 2–3 on page 2–6.)

† IBM 6400 printers can print a combination of NLQ (Serif or Sans Serif) and several additional print attributes (such as compressed, emphasized, and super/subscript). However, the IBM Proprinter prints only a subset of these attributes when the same control codes are combined (see Table 2–3 on page 2–6).

WARNING: If you specify any value other than the ones shown in the table, unpredictable results may occur.

Print Quality

ASCII Code ESC x *n*

Hex Code 1B 78 *n*

Dec Code 27 120 *n*

Purpose This code selects a print quality.

where:
n = hex 0 or hex 30 selects DP print quality
n = hex 1 or hex 31 selects NLQ Serif print quality
n = hex 2 or hex 32 selects Draft print quality
n = hex 3 or hex 33 selects OCR A print quality
n = hex 4 or hex 34 selects OCR B print quality

Comment Print qualities selected with this command override operator panel selections. Selecting an OCR print quality overrides any character attributes already set, such as condensed, double-wide, etc., and forces 10 cpi. Character attributes set when OCR is selected will be ignored.

NOTE: Some print attributes (such as condensed, double-wide, etc.) may not return to their previous setting when changing from OCR-A or OCR-B back to another Print Quality. For guaranteed results, all print attributes should be set after the Print Quality is selected.

† IBM 6400 printers print at 17.16 cpi when NLQ Serif is combined with Condensed (SI) and 12 CPI (ESC :). The IBM Proprinter prints at 20 cpi or 12 cpi with the same combination, depending on the IBM Proprinter's panel settings (see Table 2–3 on page 2–6.)

† IBM 6400 printers can print a combination of NLQ Serif and several additional print attributes (such as compressed, emphasized, and super/subscript). However, the IBM Proprinter prints only a subset of these attributes when the same control codes are combined (see Table 2–3 on page 2–6).

Proportional Spacing

ASCII Code ESC P *n*

Hex Code 1B 50 *n*

Dec Code 27 80 *n*

Purpose Enables/disables proportional spacing of characters.

where: *n* may range from 0 to 255 –
n = 1, 3, 5...(any odd value) enables proportional spacing
n = 0, 2, 4...(any even value) disables proportional spacing

Comment This command is ignored when a non–proportional font is used.

† IBM 6400 printers print proportional spacing and NLQ Serif when this control code and the ESC I control code for NLQ Serif are combined. The IBM Proprinter prints proportional spacing and NLQ Sans Serif (instead of NLQ Serif). (See Table 2–3 for further information.)

† The IBM 6400 and IBM Proprinter, print *only* proportional spacing, when the following control codes are combined:

- Proportional spacing and 12 CPI will print as proportional spacing *only*.
- Proportional spacing and Condensed will print as proportional spacing *only*.

Select Attributes

ASCII Code ESC [@ *n1* 0 0 0 *n2 n3*

Hex Code 1B 5B 40 *n1* 0 0 0 *n2 n3*

Dec Code 27 91 64 *n1* 0 0 0 *n2 n3*

Purpose Selects double high and double wide attributes, and single or double high line spacing.

Discussion Parameter *n1* selects the attributes from *n2* and *n3*, as follows:

n1 **Hex Value**	**Function**
03	Set character height and line feed settings according to the value of *n2*. (If *n1* = 03, there is no *n3*.
04	Set character height, line feed, and character settings according to the values of *n2* and *n3*.

Parameter *n2* defines the height attributes, as follows:

n2 **Hex Value**	**Function**
00	No change
01	Set single line height characters
02	Set double height characters
10	Set single line spacing
11	Set single height characters and single line spacing
12	Set double high characters and single line spacing
20	Set double line spacing
21	Set single height characters and double line spacing
22	Set double high characters and double line spacing

Parameter *n3* defines the width attributes, as follows:

n3 Hex Value	Function
00	No change
01	Set single wide characters
02	Set double wide characters

An ESC [@ code can occur at any place in the datastream and is acted upon immediately.

All numerical parameters are in the 00 to FF hex range unless stated otherwise.

† IBM 6400 printers can combine printing double–high with Draft, 12 CPI, or NLQ Serif. The IBM Proprinter has unexpected results when the same combinations of attributes are printed. (see Table 2–3 on page 2–6).

† For the IBM 6400, and Proprinter, only one of two control codes takes effect when the double–high control code is combined, as follows:

- Double–high characters combined with Super/Subscript (ESC S *n*) or Condensed (SI) will print as double–high *only.*
- Double–high characters combined with All–Points–Addressable Graphics (ESC K, ESC L, ESC Y, ESC Z) will print as All–Points–Addressable Graphics *only.*.

† The IBM 6400 prints both double-wide and NLQ Serif when this control code (*n3*=02) and the control code for NLQ Serif (ESC I) are combined. The IBM Proprinter prints double-wide and NLQ Sans Serif if control codes for double-wide and NLQ Serif are combined. (See Table 2–3 for further information.)

Superscript/Subscript Printing

ASCII Code ESC S *n*

Hex Code 1B 53 *n*

Dec Code 27 83 *n*

Purpose Selects superscript or subscript printing.

where: *n* may range from 0 to 255 –
n = 01, 03, 05 (any odd value), selects subscript printing.
n = 00, 02, 04 (any even value), selects superscript printing.

Discussion When the super/subscript command is received, all characters will be superscript or subscript until reset by the super/subscript reset command or printer reset. Super/subscript print modes are not available for the double high attribute.

NOTE: Superscript and subscript characters print at the same size as the current font, shifted up or down relative to the print line.

† IBM 6400 printers allow you to combine super/subscript printing with NLQ (Serif/Sans Serif), bold, or 12–high characters; the IBM Proprinter does not print these combinations (see Table 2–3 on page 2–6).

Superscript and subscript printing will not occur if this control code is combined with double–high (ESC[@, n2 = 2,12,22).

Example The following sample program illustrates superscript/subscript printing.

```
10 LPRINT "Control Code ESC S 0 selects";
20 LPRINT CHR$(27);"S";CHR$(0);" SUPERSCRIPT";CHR$(27);"T"
30 LPRINT "A";CHR$(27);"S";CHR$(0);"2";CHR$(27);"T";
40 LPRINT "+B";CHR$(27);"S";CHR$(0);"2";CHR$(27);"T";
50 LPRINT "=C";CHR$(27);"S";CHR$(0);"2";
60 LPRINT CHR$(27);"T"
70 LPRINT "Control Code ESC S 1 selects";
80 LPRINT CHR$(27);"S";CHR$(1);" SUBSCRIPT";CHR$(27);"T"
90 LPRINT "31";CHR$(27);"S";CHR$(1);"HEX";CHR$(27);"T";
100 LPRINT " 49 ";CHR$(27);"S";CHR$(1);"DEC";
110 LPRINT CHR$(27);"T"
120 LPRINT "Control Code ESC T cancels"
130 LPRINT "superscript/subscript printing."
```

```
Control Code ESC S 0 selects SUPERSCRIPT
A2+B2=C2
Control Code ESC S 1 selects SUBSCRIPT
31HEX 49 DEC
Control Code ESC T cancels
superscript/subscript printing.
```

Superscript/Subscript Printing, Cancel

ASCII Code ESC T

Hex Code 1B 54

Dec Code 27 84

Purpose Cancels superscript and subscript printing (as set by ESC S). This code can occur at any place in the datastream and is acted upon immediately.

Set Top-of-Form

ASCII Code ESC 4

Hex Code 1B 34

Dec Code 27 52

Purpose Sets the current paper position as the top-of-form.

Tab, Horizontal

ASCII Code HT

Hex Code 09

Dec Code 09

Purpose Moves the logical printhead right to the next horizontal tab stop.

Discussion Power-on default horizontal tabs are set at every eighth character starting at position 9 (9, 17, 25 ...). If there are no horizontal tabs set or the logical printhead is located at the last character column, the code is ignored and no movement occurs.

If double-wide, double-high attributes are enabled, single-wide character spacing is used.

Horizontal tabs are stored as a relative position; therefore, character pitch changes will change horizontal tab positions. Refer to the ESC D control code description (page 2–61) to set new tab positions.

Tab Set/Clear, Horizontal

ASCII Code ESC D *n1 n2...nk* 0

Hex Code 1B 44 *n1 n2...nk* 00

Dec Code 27 68 *n1 n2...nk* 00

Purpose Sets up to 28 horizontal tab positions.

Discussion *n1*, *n2*, up to *nk* denote character column positions for tab stops (at the current character pitch), where *n1* and *n2* represent the first two tab stops and *nk* is the final tab stop. You may specify from 1 up to 28 tab stops (all parameters after 28 are ignored). The leftmost character column position is 1. The value for each tab stop can range from 1 through 255, inclusive, and all tabs must be specified in ascending order. Any out-of-order symbols are ignored, though the remainder of the sequence is processed.

If you are defining a sequence of tabs, terminate the string with a 00H (*not* an ESC D 00H). If you want *every column* to be set with a horizontal tab, use ESC D 00H. If only one tab position is set and it is beyond the right margin, then every column is also set as a horizontal tab.

Any change in character pitch within a line changes the tab positions for the entire line. All control codes that define horizontal distance expressed in units of characters are stored internally in character columns.

Example The following example illustrates horizontal tab setting and accessing.

```
10 LPRINT "Control code"
20 LPRINT "ESC D CHR$(4);CHR$(10);CHR$(0)"
30 LPRINT "sets tab stops at columns 4 and 10."
40 LPRINT "Control code HT"
50 LPRINT "accesses the tab stops as follows:"
60 LPRINT CHR$(27);"D";CHR$(4);CHR$(10);CHR$(0);
70 LPRINT CHR$(9);
80 LPRINT "column 4"
90 LPRINT CHR$(9);CHR$(9);
100 LPRINT "column 10"
```

```
Control code
ESC D CHR$(4);CHR$(10);CHR$(0)
sets tab stops at columns 4 and 10.
Control code HT
accesses the tab stops as follows:
   column 4
          column 10
```

Tab, Vertical

ASCII Code VT

Hex Code 0B

Dec Code 11

Purpose Prints the data in the buffer and advances the paper to the next vertical tab position.

Discussion In the Proprinter III XL emulation, vertical tab positions are set by control code ESC B and executed by control code VT. In this mode, if vertical tabs are loaded, the paper position moves to the next vertical tab position.

If a vertical tab format is not defined, the paper position is advanced to the next line at the current line spacing. If a vertical tab format is defined but no vertical tab positions are set between the current print position and the end of the form, the paper position is advanced to the top of the next form. The VT code resets all single line print attributes. More information on vertical tabs is provided in Chapter 8.

If configured for LF = CR + LF (LF equals new line), the character position indicator is positioned at character column 1 of the new line. Otherwise, the character position indicator does not move.

Tab Set/Clear, Vertical

ASCII Code ESC B *n1 n2 ... nk* 0

Hex Code 1B 42 *n1 n2 nk* 00

Dec Code 27 66 *n1 n2 nk* 00

Purpose Sets or clears vertical tab positions.

Discussion The physical position on the paper is defined by *n* and the current line spacing.

where: *n* = vertical tab setting (in lines), and *k* = number of tabs possible.

The value of *n* can be defined in the range of 1 to 255, inclusive, while *k* is defined in the range of 1 to 64. Any value for *k* over 64 is ignored. Subsequent line spacing changes affect the tab position. If the value of *n* exceeds the forms length, that tab position is ignored.

Vertical tab positions are set by the command ESC B and executed by the command VT. The tab positions must be in ascending order, or the emulation ignores the out-of-order symbols. If the ESC B command is followed immediately by 00H, the vertical tab positions are cleared.

Example The following sample program illustrates Vertical Tab Setting. To run the sample, set your printer at top-of-form.

```
10 LPRINT "Line one - The control code"
20 LPRINT "ESC B 5 10 0 sets a vertical tab at line 5 and at line 10."
30 LPRINT CHR$(27);"B";CHR$(5);CHR$(10);CHR$(0);
40 LPRINT "Control code VT moves paper to the next vertical tab."
50 LPRINT CHR$(11);
60 LPRINT "Control code VT moves paper to the next vertical tab."
70 LPRINT CHR$(11);
80 LPRINT "This is line ten."
```

```
Line one - The control code
ESC B 5 10 0 sets a vertical tab at line 5 and at line 10.
Control code VT moves paper to the next vertical tab.

Control code VT moves paper to the next vertical tab.


This is line ten.
```

Tabs, Clear All (Return to default)

ASCII Code ESC R

Hex Code 1B 52

Dec Code 27 82

Purpose Clears all horizontal and vertical tab stops.

Discussion When ESC R is invoked, horizontal tab stops reinitialize to every eight columns, starting at column 9 (9, 17, 25,...). In addition, the vertical tabs are cleared.

Underline

ASCII Code ESC - *n*

Hex Code 1B 2D *n*

Dec Code 27 45 *n*

Purpose Enables or disables automatic underlining of all characters.

Discussion When automatic underline is enabled, all characters, including spaces, are underlined until disabled.

where: *n* may range from 0 to 255 –
n = 01, 03, 05 ... (any odd value) selects underlining.
n = 00, 02, 04 ... (any even value) cancels underlining.

† The IBM 6400 and Proprinter print *only* 12–High characters when this control code is combined with 12–High characters. See Table 2–3 on page 2–6. (12–high characters are characters in the upper ASCII character set for code pages 437 and 850, in positions 176–233, or 244).

Example The following sample program illustrates automatic underlining and underlining reset.

```
10 LPRINT "Control code ESC -1"
20 LPRINT CHR$(27);"-";CHR$(1);
30 LPRINT "enables automatic underlining."
40 LPRINT "Control code ESC -0"
50 LPRINT CHR$(27);"-";CHR$(0);
60 LPRINT "disables automatic underlining."
```

```
Control code ESC -1
enables automatic underlining.
Control code ESC -0
disables automatic underlining.
```

Unidirectional Printing

ASCII Code ESC U *n*

Hex Code 1B 55 *n*

Dec Code 27 85 *n*

Purpose Sets or cancels unidirectional printing.

Discussion This code sets or cancels unidirectional printing, as follows:

where: *n* may range from 0 to 255 –

n = 01, 03, 05 ... (any odd value) selects unidirectional text printing.
n = 00, 02, 04 ... (any even value) cancels unidirectional text printing.

3 Epson FX–1050 Emulation

Chapter Contents

Overview

This chapter describes the Epson FX–1050 emulation host control codes that are supported for the IBM 6400 ASCII printers. Emulation refers to the ability of a printer to execute the commands of a particular printer control language. A printer control language is the coding system used to convey, manipulate, and print data. Carriage Return, print quality, character attributes such as bold and underline, margins, and tabs are typical functions selected by printer control language codes. In this manual, the terms emulation, printer protocol, and printer control language are synonymous.

In Epson emulation mode, the 6400 can print files coded for the Epson printer control language. To select the Epson emulation mode as the active printer configuration, refer to the description of the ASCII Emulation Selection option in Chapter 4 of the *IBM 6400 Line Matrix Printer Setup Guide* (PN S246–0116).

The Epson emulation provides many configurable parameters. The default parameter values for this emulation are shown in Table 3–1. You can modify these parameter values in two ways:

- **The Epson host control codes.** An extensive set of Epson control code commands can be sent to the printer from an attached host computer via the host data stream. Most of this chapter is devoted to describing the Epson control code commands.
- **The printer configuration menus.** You can modify a subset of the Epson emulation parameters using the operator panel switches and LCD display, as described in the *Setup Guide*.

Control codes sent from a host system generally override previous settings that result from the configuration menus. However, any configuration settings from host control codes will be gone once the printer is powered off (or reset to the default values), unless you have saved them to NVRAM using the configuration menus. The *Setup Guide* describes the Save Custom Sets option for saving changes to NVRAM.

The emulation's response to several of the control codes depends on the configuration. For example, upon receipt of the carriage return control code, the emulation will either perform a carriage return function only, or a carriage return and line feed, based on the configuration for the CR function.

Default Values and States

Your printer's onboard memory stores a set of typical operating states and conditions for the Epson emulation. When you power on the printer and select this emulation, the factory settings in Table 3–1 are automatically invoked.

Table 3–1. Epson Emulation Default Settings

Characteristic	Default Setting
Character Set	Epson Set
Epson Print Language	ASCII (USA)
Define CR Code	CR = CR
Auto Line Feed	Enable
Define LF Code	LF = LF
Printer Select	Disable
20 CPI Condensed	Enable

Table 3–2 lists several additional default settings for parameters that are provided by the Print Format menus (described in Chapter 4 of the *Setup Guide*). Many of the settings shown in Table 3–2 can be overridden by Epson FX–1050 host control codes for the same parameter.

Table 3–2. Print Format Default Settings

Characteristic	Default Setting
CPI	10.0
LPI	6.0
Forms Width	Inches, 13.6 inches MM 345.4 mm Char. 136 characters
Forms Length	Inches 11.0 inches Millimeters 279 mm Lines 66 lines
Print Quality	DP Quality
Proportional Spacing	Disable
Italic Print	Disable
Slashed Zero	Disable
Left Margin	0 columns
Right Margin	0 columns
Bottom Margin	0 lines
Perforation Skip	Disable

Epson Emulation Exceptions and Differences

Because of mechanical differences between your printer(s) (line matrix printers) and Epson printers (moving printhead serial matrix printers), some Epson features are approximated or not supported.

- Epson codes that produce different behavior in your printer are indicated by a "dagger" (†) in the Control Code Index and code section.
- The Epson emulation supports the following fonts: DP, NLQ Serif and Sans Serif, Draft with 10 cpi, 12 cpi and 15 cpi in either condensed or normal widths, and OCR A and OCR B in 10 cpi. Condensed printing at 10 cpi in DP quality maps to 17.1 cpi. Character pitches other than 10 DP cpi map to 20 cpi in DP and 17.1 cpi in NLQ.
- Epson bit–image graphics are supported, including all plotter and CRT densities.
- Many character sets are available, including IBM–PC Graphics (IBM Code Page 0437) and Epson. You can configure the zero character to contain a slash or no slash.
- The Double Wide print control codes (ESC W, SO) double character width, but *not* inter–character spacing, unlike the Epson FX–1050. The formulas for total character spacing are as follows:

Epson FX–1050	2 (char + 1 dot + space)
6400 Epson Emulation	2 (char + 1 dot) + space

- The Condensed Print (SI) control code condenses character width but *not* inter-character spacing, unlike the Epson FX–1050 which condenses both character width *and* spacing.
- If one or more Backspace control codes follow directly after a Bit Image Graphics command (ESC K, ESC L, ESC Y, or ESC Z), the 6400 printers will backspace into the graphic pattern, the number of dots depending on the current cpi setting. For an Epson FX–1050 printer, one Backspace will send the logical printhead directly to the beginning of the graphics pattern.
- When backspacing over proportionally spaced characters, Epson printers move back the width of each proportional character; this emulation moves back based on the current cpi setting, as if proportional spacing is disabled.

Epson Character Sets

Epson printers use five character sets. The IBM Graphics code page 437, IBM PC Multilingual code page 0850, OCR A, and OCR B character sets may be selected from the configuration menus. In addition, there is a unique Epson character set. The Epson character set (shown in Figure 3–1) is basically the ASCII character set with the upper, non–ASCII set defined as italics, and the usually unprintable codes designated as international characters.

Hex	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	à	§	SP	0	@	P	‘	p	*à*	*§*	*SP*	*0*	*@*	*P*	*‘*	*p*
1	è	β	!	1	A	Q	a	q	*è*	β	*!*	*1*	*A*	*Q*	*a*	*q*
2	ù	DC2	”	2	B	R	b	r	*ù*	*Æ*	*”*	*2*	*B*	*R*	*b*	*r*
3	ò	DC3	#	3	C	S	c	s	*ò*	*æ*	*#*	*3*	*C*	*S*	*c*	*s*
4	ì	DC4	$	4	D	T	d	t	*ì*	*∅*	*$*	*4*	*D*	*T*	*d*	*t*
5	°	Ø	%	5	E	U	e	u	°	*∅*	*%*	*5*	*E*	*U*	*e*	*u*
6	£	¨	&	6	F	V	f	v	£	¨	*&*	*6*	*F*	*V*	*f*	*v*
7	BEL	Ä	‘	7	G	W	g	w	*i*	*Ä*	*’*	*7*	*G*	*W*	*g*	*w*
8	BS	CAN	(	8	H	X	h	x	*¿*	*Ö*	*(*	*8*	*H*	*X*	*h*	*x*
9	HT	Ü	)	9	I	Y	i	y	*Ñ*	*Ü*	*)*	*9*	*I*	*Y*	*i*	*y*
A	LF	ä	*	:	J	Z	j	z	*ñ*	*ä*	*	*:*	*J*	*Z*	*j*	*z*
B	VT	ESC	+	;	K	[	k	{	¤	*ö*	+	*;*	*K*	*[*	*k*	*{*
C	FF	ü	’	<	L	\	l	|	*Pt*	*ü*	,	<	*L*	**	*l*	|
D	CR	É	–	=	M	]	m	}	*Å*	*É*	–	=	*M*	*]*	*m*	*}*
E	SO	é	.	>	N	^	n	~	*å*	*é*	.	>	*N*	^	*n*	~
F	SI	¥	/	?	O	_	o	DEL	*Ç*	¥	*/*	*?*	*O*	_	*o*	Ø

Figure 3–1. Epson Character Set

The international characters in 00–1F and 80–9F appear when you invoke control code “ESC I 1”. You may use the Epson configuration menus described in Chapter 4 of the *Setup Guide* (or the “ESC R” control code) to select an international character set. Appendix E provides print samples for each character set, shown in NLQ and Draft print modes. A table on page 3–9 provides detailed notes on print mode support for each character set.

Normally, these characters are either blank or control codes. The implementation is that the control codes hide the non–italic international characters, even in hex 00 through 1F, and DEL. DEL conceals the non–italic slashed zero.

Configuring the Epson FX–1050 Emulation with Control Codes

The remainder of this chapter describes the Epson printer control language codes that may be sent from a host computer attached to the printer, in order to invoke and configure numerous Epson emulation functions.

Format for Control Code Descriptions

The following information is listed for each control code (where applicable):

Name The title or function of the command.

ASCII Code The ASCII mnemonic for the command is shown for the IBM 6400 ASCII printers, and the Epson FX protocol. Command sequences are in 7-bit (ASCII) form.

Hex Code The code or command sequence in hexadecimal numbers.

Dec Code The code or command sequence in decimal numbers.

Expression The control codes used in the BASIC programming language.

Purpose The function(s) of the control code.

Discussion A discussion of the uses of the code or command sequence, including a description of exceptions or limitations to normal use.

Example A sample written in BASIC programming language is provided when it is possible to illustrate the effect of a control code or if a specific syntax is required. The programs in this chapter were run on an IBM Personal Computer using Microsoft** GW-BASIC** version 3.22.

† ("dagger") This symbol means the code produces non–Epson behavior in your printer.

IMPORTANT

All print samples in this chapter were run on an impact printer that has a dot resolution of 1/60–inch horizontally and 1/72–inch vertically.

WARNING: If you specify any parameters for a control code other than the ones that are defined in the control code description, unpredictable results may occur.

Escape Sequences

An Epson control code consisting of more than one character is called an escape sequence because the first character in the sequence is always the ASCII ESCape character. ESC alerts the printer that a special function command—not printable characters—follows.

The format for an Epson escape sequence is:

(ESC)(parameter 1)(parameter 2)...(parameter n)

For example, to select emphasized (offset) print, send the ESC character immediately followed by the E character (do not add a space character):

ASCII: ESC E **Hex:** 1B 45 **BASIC:** CHR$(27);"E";

NOTE: In a BASIC program ESC sequences must end with a semicolon (;) or with text following the escape sequence. A paper motion command directly following an escape sequence may result in unwanted paper movement.

Set and Reset Codes

Set and reset are another way of saying turn on and turn off, select and deselect, or enable and disable.

Some printer features are set and reset with an escape sequence and the numbers 1 or 0. In such cases you can represent 1 and 0 as hexadecimal codes 01 and 00, or as the ASCII codes for the numerals 1 and 0 (hexadecimal 31 and 30).

NUL Code

NUL (Hex 00) is ignored by the printer and can be used as a fill character; however, it can not be used to add blank spaces since it is not a space character. NUL can also be used as a parameter terminator for the Set Horizontal Tabs (page 3–35) or Set Vertical Tabs multibyte control code (page 3–66).

NOTE: Hex '80' in the 0437 PC Character Set and Hex '7F' in the 0850 PC Character Set are treated as a NUL; however, these two controls can not be used as parameter terminators.

Print Modes Supported for Character Sets

Following is a summary of which print modes are supported for the Epson FX-1050 emulation character sets. Additional information about character set support is provided under the heading "Notes." The code pages for the character sets listed in Table 3–3 are shown in Appendix E, in Draft mode and NLQ mode.

NOTE: The print mode support for the languages shown in Table 3–3 (Epson Set ASCII and following) is the same for the Epson expanded character sets and the Epson 0437 PC character sets.

Table 3–3. Character Set Print Mode Support

Character Set	NLQ	DP	Draft	Notes
0437 PC Character Set	X	X	X	
0850 PC Multilingual	X	X	X	
OCR–A / OCR–B	N/A	N/A	N/A	OCR is 10 cpi only
Epson Set ASCII (USA)	X	X	X	
Epson Set French	X	X	X	
Epson Set German	X	X	X	
Epson Set English (UK)	X	X	X	
Epson Set Danish I	X	X	X	
Epson Set Swedish	X	X	X	
Epson Set Italian	X	X	X	
Epson Set Spanish I	X	X	X	
Epson Set Japanese	X	X	X	
Epson Set Norwegian	X	X	X	
Epson Set Danish II	X	X	X	
Epson Set Spanish II	X	X	X	
Epson Set Latin American I	X	X	X	
Epson Set French Canadian	X	X	X	
Epson Set Latin American II	X	X	X	

The Control Codes

The following index lists the control codes by function, ASCII mnemonic, and page number. Some control code functions can also be selected at the operator panel.

† = Produces non–Epson behavior in your printer.

	FUNCTION	ASCII CODE	PAGE
	Horizontal Motion (continued)		
	Character Pitch 10 cpi	ESC P	3–15
	Set Margin (Left)	ESC l	3–56
	Set Margin (Right)	ESC Q	3–56
	Proportional Spacing, Select/Deselect	ESC p	3–53
	Emphasis		
	Cancel Emphasized (Offset) Print	ESC F	3–27
	Cancel Italic Printing	ESC 5	3–37
	Cancel Superscript or Subscript Printing	ESC T	3–62
†	Condensed Print	SI (or ESC SI)	3–19
	Condensed Print Reset	DC2	3–20
†	Double High Print, Set/Reset	ESC w	3–22
	Double Strike	ESC G	3–23
	Double Strike, Cancel	ESC H	3–23
†	Double Wide Print	ESC W	3–24
†	Double Wide Print (1 Line)	SO (or ESC SO)	3–25
	Double Wide Print (1 Line), Cancel	DC4	3–26
	Emphasized (Offset) Print	ESC E	3–26
	Select Italic Printing	ESC 4	3–37
†	Select Superscript Printing	ESC S 0	3–61
	Underline	ESC –	3–63
	Print Quality Control		
†	Master Print Select	ESC !	3–46
†	Select User–Defined Font	ESC %	3–53
†	Define a Download Character	ESC &	3–21
†	Remove Downloaded Characters	ESC :	3–49
†	Character Pitch 15 cpi	ESC g	3–16
†	Select Serif or Sans Serif Font	ESC k	3–53
†	Select Print Quality	ESC x	3–52

† = Produces non–Epson behavior in your printer.

FUNCTION	ASCII CODE	PAGE
Character Set Manipulation		
Make 80–9F Hex Printable	ESC 6	3–44
Make 80–9F Control Codes	ESC 7	3–44
Enable Printing of Hex Codes 00–1F and 80–9F	ESC I	3–27
Set International Character Set	ESC R	3–17
Select Italic Character Set	ESC t *n*	3–51
Data Manipulation		
Cancel Line	CAN	3–14
Delete Character	DEL	3–21
Pass Bit 7 from Host	ESC #	3–47
† Clear Bit 7 of Incoming Data Bytes to 0	ESC =	3–18
Set Bit 7 of Incoming Data Bytes to 1	ESC >	3–55
Graphics		
† Select Graphics Mode	ESC *	3–50
Reassign Graphics Mode	ESC ?	3–49
Select 9–Pin Graphics Mode	ESC ^	3–51
Single Density Bit–image Graphics	ESC K	3–30
Double Density Bit–image Graphics	ESC L	3–31
Double Density with No Adjacent Dots	ESC Y	3–32
Quadruple Density Graphics	ESC Z	3–33
Miscellaneous Printer Control		
Initialize Printer	ESC @	3–36
Printer Select	DC1	3–48
Printer Deselect	DC3	3–48
Unidirectional Printing, 1 Line	ESC <	3–64
Unidirectional Printing, Set/Reset	ESC U	3–64
† Turn Half–Speed Mode On or Off	ESC s	3–34
Bell (Printer beeps 200 ms)	BEL	3–14
† Cut–Sheet/Paper Feed Control	ESC EM	3–21

† = Produces non–Epson behavior in your printer.

Backspace

ASCII Code BS

Hex Code 08

Dec Code 08

Purpose Moves the logical print head to the left one character space toward the first character column.

Discussion Assures that the previous printable characters will be printed, then moves the logical print head one character space to the left at the current pitch setting (which includes double wide and *ESC SP*). If the logical print head bumps into the left margin, it stops.

† When backspacing over proportionally spaced characters, Epson printers move back the width of each proportional character; this emulation moves back based on the current cpi setting, as if proportional spacing is disabled.

† If one or more Backspace control codes follow directly after a Bit Image Graphics command (ESC K, ESC L, ESC Y, or ESC Z), the 6400 printers will backspace into the graphic pattern, the number of dots depending on the current cpi setting. For an Epson FX–1050 printer, one Backspace will send the logical printhead directly to the beginning of the graphics pattern.

Example Print and backspace two character positions.

```
10 LPRINT "TTTTT";
20 LPRINT CHR$(8);CHR$(8);
30 LPRINT "=="
```

```
TTT==
```

Bell

ASCII Code BEL

Hex Code 07

Dec Code 07

Purpose Sounds the printer's buzzer/beeper.

Discussion The BEL function will sound the buzzer/beeper for 0.2 seconds upon receipt of this command.

Cancel Line

ASCII Code CAN

Hex Code 18

Dec Code 24

Purpose Clears all unprinted data from a line, but does not affect control codes.

Discussion You can use this control code to delete a line, but do so with caution to avoid possible misprinting. This control code cancels the double wide attribute set by SO. No other print attributes are affected. The logical print head goes to the print position it had after the last CR or paper motion command.

Carriage Return

ASCII Code CR

Hex Code 0D

Dec Code 13

Purpose Prints the data in the buffer, then returns the logical print head to the left margin.

Discussion Subsequent data are emphasized. A line feed will be appended if the printer is configured from the operator panel for CR = CR + LF. When CR = CR + LF, this code cancels all one–line–only emphasis and font controls: double–wide from SO and ESC SO, and unidirectional printing from ESC <.

Character Pitch 10 CPI

ASCII Code ESC P

Hex Code 1B 50

Dec Code 27 80

Purpose Sets character pitch to 10 characters per inch (cpi).

Discussion This command is normally used to cancel 12 cpi.

Character Pitch 12 CPI

ASCII Code ESC M

Hex Code 1B 4D

Dec Code 27 77

Purpose Sets character pitch to 12 characters per inch (cpi).

Discussion This command is available in all print modes except OCR A and OCR B.

Character Pitch 15 CPI

ASCII Code ESC g

Hex Code 1B 67

Dec Code 27 103

Purpose Sets character pitch to 15 characters per inch (cpi).

† Discussion This command is not defined in Epson FX printers. It is included in this emulation for compatibility with the Okidata KX-P1180 printer. This command is available in all print modes except OCR A and OCR B.

Character Set Select: International Languages

ASCII Code ESC R *n*

Hex Code 1B 52 *n*

Dec Code 27 82 *n*

Purpose Specifies a language overlay that prints the characters shown in Table 3–4 when the specified code is invoked.

Appendix E provides print samples for each character set, shown in NLQ and Draft print modes. A table on page 3–9 provides detailed notes on print mode support for each character set.

where *n* = hex 0 through e to determine the language overlay shown in Table 3–4 below. Epson only defines character sets through hex c.

Table 3–4. Epson International Character Sets

(Hex) If *n*=	International Character Set Is:	Hex Codes											
		23	24	40	5b	5c	5d	5e	60	7b	7c	7d	7e
0	USA	#	$	@	[	\	]	^	`	{	¦	}	~
1	French	#	$	à	°	ç	§	^	`	é	ù	è	¨
2	German	#	$	§	Ä	Ö	Ü	^	`	ä	ö	ü	ß
3	English (UK)	£	$	@	[	\	]	^	`	{	¦	}	~
4	Danish I	#	$	@	Æ	Ø	Å	^	`	æ	ø	á	~
5	Swedish	#	¤	É	Ä	Ö	Å	Ü	é	ä	ö	á	ü
6	Italian	#	$	@	°	\	é	^	ù	à	ò	è	ì
7	Spanish I	₧	$	@	¡	Ñ	¿	^	`	¨	ñ	}	~
8	Japanese	#	$	@	[	¥	]	^	`	{	¦	}	~
9	Norwegian	#	¤	É	Æ	Ø	Å	Ü	é	æ	ø	á	ü
a	Danish II	#	$	É	Æ	Ø	Å	Ü	é	æ	ø	á	ü
b	Spanish II	#	$	á	¡	Ñ	¿	é	`	í	ñ	ó	ú
c	Latin American I	#	$	á	¡	Ñ	¿	é	ü	í	ñ	ó	ú
d	French Canadian	#	$	à	â	ç	ê	î	ô	é	ù	è	û
e	Latin American II	#	$	@	[	Ñ	]	ú	í	ó	á	é	ü

Character Set Select: International Languages (continued)

Discussion This control code setting overrides a character set selection made at the operator panel.

Example The following example illustrates international character selection using the IBM PC character set.

```
10 LPRINT "Control code ESC R 5 selects"
20 LPRINT "the Swedish character set shown beneath"
30 LPRINT "the USA (ASCII) characters."
40 LPRINT
50 LPRINT "A B C D [ \ ] ^ _ ` { | } ~"
60 LPRINT CHR$(27);"R";CHR$(5);
70 LPRINT "A B C D [ \ ] ^ _ ` { | } ~"
80 LPRINT CHR$(27);"R";CHR$(0);
```

```
Control code ESC R 5 selects
the Swedish character set shown beneath
the USA (ASCII) characters.

A B C D [ \ ] ^ _ ` { | } ~
A B C D Ä ö Å Ü _ é ä ö å ü
```

Clear Bit 7 of Incoming Data Bytes to 0

ASCII Code ESC =

Hex Code 1B 3D

Dec Code 27 61

Purpose Sets the most significant bit (MSB) of all incoming data to 0.

Discussion The MSB is bit number 7. This command only affects text and control code data. Graphics data pass through unchanged. Some applications always set the MSB of print data to one (1), which results in italic or graphics printing in Epson printers. This command overcomes the problem.

NOTE: This command does not suppress hexadecimal 'FF' from printing.

Condensed Print

ASCII Code	SI	ESC SI
Hex Code	0F	1B 0F
Dec Code	15	27 15

Purpose Condenses print pitch as close to 60% of the former character width as possible (up to 20 characters per inch).

Discussion The condensed print command affects all subsequent characters. After the printer receives code SI, all characters are printed condensed (approximately 60 per cent of the width of normal characters) until the printer is reset by ESC M, ESC P, DC2, a printer reset, or a new print mode control code. SI code (hex 0F) is equivalent to the ESC SI code. If condensed print is not allowed in the current font, this code is ignored. Proportionally spaced text cannot be condensed. Proportional spacing overrides condensed printing.

When condensed print is selected, the following character pitches go into effect:

- DP 10 cpi condenses to DP 17.1 cpi. NLQ 10, 12, and 15 cpi condense to NLQ 17.1 cpi. Draft 10 cpi condenses to Draft 17.1 cpi.
- DP 12 and 15 cpi condense to DP 20. Draft 12 and 15 cpi condense to Draft 20.

† This control code condenses character width but *not* inter-character spacing. An actual Epson FX–1050 printer condenses both character width *and* spacing.

If Condensed Print is combined with Double High (ESC w) printing, *only* Double High printing will occur.

Example The program below shows condensed character printing and reset.

```
10 LPRINT "Control code"
20 LPRINT "SI selects"
30 LPRINT CHR$(15);
40 LPRINT "condensed character printing."
50 LPRINT "Control code DC2"
60 LPRINT CHR$(18);
70 LPRINT "resets condensed character printing."
```

```
Control code
SI selects
condensed character printing.
Control code DC2
resets condensed character printing.
```

Condensed Print Reset

ASCII Code DC2

Hex Code 12

Dec Code 18

Purpose Cancels the condensed print mode set by SI, ESC SI, or the operator panel.

Discussion This returns the printer to the font that was active before condensed print occurred. Other print attributes are not affected.

Example See the Condensed Print control code (page 3–19) for an example of Condensed Print Reset.

Cut–Sheet / Paper Feed Control

ASCII Code ESC EM *n*

Hex Code 1B 19 *n*

Dec Code 27 25 *n*

Purpose This code controls the paper feed mechanism on Epson printers.

† Discussion The printer ignores this command.

Define a Download Character

ASCII Code ESC &

Hex Code 1B 26

Dec Code 27 38

Purpose Defines a download character.

† Discussion The printer ignores this command and removes all downloaded font data from the data stream.

Delete Character

ASCII Code DEL

Hex Code 7F

Dec Code 127

Purpose Deletes the previous character on a line.

Discussion This command is ignored if it occurs immediately after a CR or a paper motion command. Characters truncated due to line length restrictions are not affected by this code.

Double High Print, Set/Reset

ASCII Code ESC w *n*

Hex Code 1B 77 *n*

Dec Code 27 119 *n*

Purpose Turns double-high character printing on and off. Double-high characters are standard width but twice as high.

where *n* = hex 1 or hex 31 turns double high printing on
n = hex 0 or hex 30 turns double high printing off

† Discussion The OCR A and OCR B fonts cannot be printed in double high.

NOTE: It is recommended to use double Line Feeds and Carriage Returns when double-high character printing is on (after an ESC w control code has been sent), or else the printer will overstrike text that has already printed.

† If Superscript/Subscript (ESC S) or Condensed Print (SI) is combined with Double High printing, *only* Double High printing will occur.

Example The following program illustrates double-high character printing.

```
10 LPRINT "Control Code ESC w"
20 LPRINT
30 LPRINT CHR$(27);"w";CHR$(1);
40 LPRINT "Selects Double High printing."
50 LPRINT CHR$(27);"w";CHR$(0);
60 LPRINT "Cancels Double High printing."
```

```
Control Code ESC w
Selects Double High printing.
Cancels Double High printing.
```

Double Strike

ASCII Code ESC G

Hex Code 1B 47

Dec Code 27 71

Purpose Makes text bolder by double printing each dot twice.

† Discussion This command makes text bolder by printing each dot twice, the second dot offset to the right of the first by a distance equal to 1/2 the width of a dot, the same as with ESC E.

Example The following program illustrates double strike character printing.

```
10 LPRINT "Control code ESC G"
20 LPRINT CHR$(27);"G";
30 LPRINT "selects bold character printing,"
40 LPRINT "for example: AaBbCcDdEeFfGgHhIiJjKkLlMmNnOoPp."
50 LPRINT "Control code ESC H"
60 LPRINT CHR$(27);"H";
70 LPRINT "cancels bold character printing."
```

```
Control code ESC G
selects bold character printing,
for example: AaBbCcDdEeFfGgHhIiJjKkLlMmNnOoPp.
Control code ESC H
cancels bold character printing.
```

Double Strike , Cancel

ASCII Code ESC H

Hex Code 1B 48

Dec Code 27 72

Purpose Turns off the double strike printing set by ESC G or ESC !.

Discussion This control code resets only the double strike print attribute. Other print attributes, such as double wide printing, are not affected.

Double Wide Print

ASCII Code ESC W *n*

Hex Code 1B 57 *n*

Dec Code 27 87 *n*

Purpose Turns double wide print on and off.

where *n* = hex 1 or hex 31 turns double wide print on
n = hex 0 or hex 30 turns double wide print off

Discussion When ESC W is received, all characters are printed twice as wide until reset. This command overrides SO, ESC SO, and DC4. The OCR A and OCR B fonts cannot be printed in double wide.

† This control code doubles character width, but does *not* double inter–character spacing. unlike the Epson FX–1050. The formulas for total character spacing are as follows:

Epson FX–1050	2(char + 1 dot + space)
6400 Epson Emulation	2(char + 1 dot) + space

Example The following program illustrates double wide character printing.

```
10 LPRINT "Control code"
20 LPRINT "ESC W 1 selects"
30 LPRINT CHR$(27);"W";CHR$(1);
40 LPRINT "expanded character printing."
50 LPRINT "Control code"
60 LPRINT "ESC W 0 resets"
70 LPRINT CHR$(27);"W";CHR$(0);
80 LPRINT "expanded character printing."
```

```
Control code
ESC W 1 selects
e x p a n d e d   c h a r a c t e r   p r i n t i n g .
C o n t r o l   c o d e
E S C   W   0   r e s e t s
expanded character printing.
```

Double Wide Print (1 Line)

ASCII Code	SO	ESC SO
Hex Code	0E	1B 0E
Dec Code	14	27 14

Purpose Selects double wide print for one line only.

Discussion This control code is a line–by–line print attribute; when SO or ESC SO is received, the characters on the current line print twice as wide, then automatically reset.

† This control code is cancelled by the DC4 code or by a CR code, as in the Epson FX–1050. It is *also* cancelled by a paper motion control code (LF, VT, etc.), as in the IBM Proprinter III XL.

† This control code doubles character width, but does *not* double inter–character spacing. unlike the Epson FX–1050. The formulas for total character spacing are as follows:

Epson FX–1050	2(char + 1 dot + space)
6400 Epson Emulation	2(char + 1 dot) + space

Example The following program illustrates double wide print for one line only.

```
10 LPRINT "Control code"
20 LPRINT "SO selects"
30 LPRINT CHR$(14);
40 LPRINT "expanded character printing"
50 LPRINT "for one line only."
```

```
Control code
SO selects
expanded character printing
for one line only.
```

Double Wide Print (1 Line), Cancel

ASCII Code DC4

Hex Code 14

Dec Code 20

Purpose Cancels the double wide print for one line only selected by SO or ESC SO.

Discussion This command cancels the double wide print selected by SO or ESC SO, but does not cancel double wide printing selected by ESC W or ESC !.

Emphasized Print

ASCII Code ESC E

Hex Code 1B 45

Dec Code 27 69

Purpose Selects emphasized character print format.

Discussion Emphasized print makes text bolder by printing each dot twice, the second dot offset to the right of the first by a distance equal to 1/2 the width of a dot. This command is available in both DP and NLQ modes.

Example The following program illustrates emphasized character printing.

```
10 LPRINT "Control code"
20 LPRINT "ESC E selects"
30 LPRINT CHR$(27);"E";
40 LPRINT "emphasized character printing."
42 LPRINT "Control code ESC F"
50 LPRINT CHR$(27);"F";
60 LPRINT "cancels emphasized character printing."
```

```
Control code
ESC E selects
emphasized character printing.
Control code ESC F
cancels emphasized character printing.
```

Emphasized Print , Cancel

ASCII Code ESC F

Hex Code 1B 46

Dec Code 27 70

Purpose Cancels emphasized character printing selected by ESC E or ESC !.

Discussion This command is available in both DP and NLQ modes.

Enable Printing Hex Codes 00–1F and 80–9F

ASCII Code ESC I *n*

Hex Code 1B 49 *n*

Dec Code 27 73 *n*

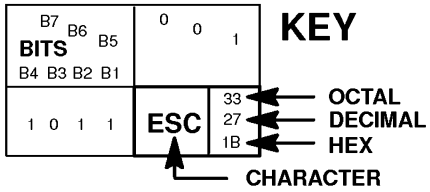
Purpose Permits you to print hex codes 00–1F and 80–9F.

where *n* = 1 allows hex codes 00–1F and 80–9F to be printable and to be used for user–defined characters.
n = 0 returns hex 00–1F and 80–9F to control codes.

Discussion The printable characters that are included in hex codes 00 through1F and 80 through 9F are usually not printable in the default state on Epson printers. Sending *ESC I 1* enables you to print characters in this range. Sending *ESC I 0* returns the codes to non–printable status.

The printable codes for the Epson character set are shown in Figure 3–2. The mapping of 00 through 1F and 80 through 9F are the same in this case. (Figure 3–2 shows the types of characters and their addresses; it is not a sample of printer output.)

Appendix E provides samples of the many character sets available with the Epson emulation.



B8 B7 B6 B5 BITS B4 B3 B2 B1	ROW	0 0 0 0 COLUMN 0		0 0 0 1 1	
0 0 0 0	0	à	0 0 0	§	20 16 10
0 0 0 1	1	è	1 1 1	ß	21 17 11
0 0 1 0	2	ù	2 2 2	DC2	22 18 12
0 0 1 1	3	ò	3 3 3	DC3	23 19 13
0 1 0 0	4	ì	4 4 4	DC4	24 20 14
0 1 0 1	5	°	5 5 5	ø	25 21 15
0 1 1 0	6	£	6 6 6	¨	26 22 16
0 1 1 1	7	BEL	7 7 7	Ä	27 23 17
1 0 0 0	8	BS	10 8 8	CAN	30 24 18
1 0 0 1	9	HT	11 9 9	Ü	31 25 19
1 0 1 0	10	LF	12 10 0 A	ä	32 26 1A
1 0 1 1	11	VT	13 11 0 B	ESC	33 27 1B
1 1 0 0	12	FF	14 12 0 C	ü	34 28 1C
1 1 0 1	13	CR	15 13 0 D	É	35 29 1D
1 1 1 0	14	SO	16 14 0 E	é	36 30 1E
1 1 1 1	15	SI	17 15 0 F	¥	37 31 1F

Epson USA Character Set

Figure 3–2. Epson Printable Codes (Hex 00–1F and 80–9F)

Form Feed

ASCII Code FF

Hex Code 0C

Dec Code 12

Purpose Prints the data in the buffer, if any, then moves the paper to the top of the next form.

Discussion The logical print head moves to the left margin. This code cancels all one–line–only emphasis and font controls: double–wide from SO and ESC SO, and unidirectional printing from ESC <.

Graphics, Standard Density

ASCII Code ESC K *n1 n2*

Hex Code 1B 4B *n1 n2*

Dec Code 27 75 *n1 n2*

Purpose Selects normal density bit image graphics of 60 dots per inch horizontally and 72 dots per inch vertically.

Expression CHR$(27);"K";CHR$(*n1*);CHR$(*n2*);"DATA"

where *(n1* + 256*n2)* defines the number of data bytes to follow.
DATA = ASCII characters for the dot pattern bytes.

NOTE: The DATA can be expressed in a CHR$(DATA) format with the appropriate decimal values of the ASCII characters supplied, especially in cases where the dot patterns of nonprintable characters are required.

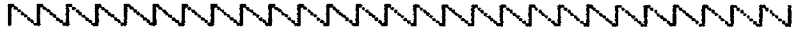
NOTE: "DATA" consist of 8–bit dot columns, with the MSB at the top, and "1" bits producing dots. For more information, refer to Chapter 7.

Discussion You can change graphics density with the *ESC ?* command.

Example The following example produces a pattern of standard density bit image graphics. The 9 data–bit pattern is repeated 27 times. Compare this example to the double density and quadruple density examples.

```
10 WIDTH "lpt1:",255
20 LPRINT "Single Density Bit Image Graphics"
30 LPRINT CHR$(27);"K";CHR$(244);CHR$(0);
40 FOR N=1 TO 27
50 RESTORE
60 FOR I=1 TO 9
70 READ R
80 LPRINT CHR$(R);
90 NEXT I
100 NEXT N
110 LPRINT CHR$(255)
120 DATA 255,128,64,32,16,8,4,2,1
```

```
Single Density Bit Image Graphics
```



Graphics, Double Density

ASCII Code ESC L *n1 n2*

Hex Code 1B 4C *n1 n2*

Dec Code 27 76 *n1 n2*

Purpose Selects double density bit image graphics of 120 dots per inch horizontally and 72 dots per inch vertically.

Expression CHR$(27);"L";CHR$(*n1*);CHR$(*n2*);"DATA"

where *(n1* + 256*n2)* defines the number of data bytes to follow.
DATA = ASCII characters for the dot pattern bytes.

NOTE: The DATA can be expressed in a CHR$(DATA) format with the appropriate decimal values of the ASCII characters supplied, especially in cases where the dot patterns of nonprintable characters are required.

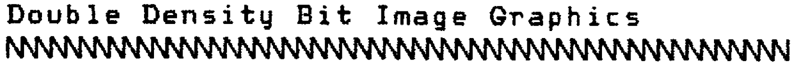
NOTE: "DATA" consist of 8–bit dot columns, with the MSB at the top, and "1" bits producing dots. For more information, refer to Chapter 7.

Discussion Double density printing reduces print speed to half that of normal density printing. You can change graphics density with the *ESC ?* command.

Example The following example produces double density bit–image graphics of the pattern used in the standard density bit–image mode example. The amount of data must be doubled for double density (the data are used 54 times rather than 27).

```
10 WIDTH "lpt1:",255
20 LPRINT "Double Density Bit Image Graphics"
30 LPRINT CHR$(27);"L";CHR$(231);CHR$(1);
40 FOR N=1 TO 54
50 RESTORE
60 FOR I=1 TO 9
70 READ R
80 LPRINT CHR$(R);
90 NEXT I
100 NEXT N
110 LPRINT CHR$(255)
120 DATA 255,128,64,32,16,8,4,2,1
```

```
Double Density Bit Image Graphics
```



Graphics, Double Density Double Speed

ASCII Code ESC Y *n1 n2*

Hex Code 1B 59 *n1 n2*

Dec Code 27 89 *n1 n2*

Purpose Selects double density, double speed bit–image graphics of 120 dpi horizontally and 72 dpi vertically.

Expression CHR$(27);″Y″;CHR$(n1);CHR$(n2);″DATA″

where *(n1* + 256*n2)* defines the number of data bytes to follow.
DATA = ASCII characters for the dot pattern bytes.

NOTE: The DATA can be expressed in a CHR$(DATA) format with the appropriate decimal values of the ASCII characters supplied, especially in cases where the dot patterns of nonprintable characters are required.

NOTE: "DATA" consist of 8–bit dot columns, with the MSB at the top, and "1" bits producing dots. For more information, refer to Chapter 7.

Discussion This mode prints double density with no adjacent dots. It is similar to ESC L, except that if the graphics data contain horizontally adjacent dots, the data may print incorrectly. This feature is widely used to move the print head precisely, by printing blank dot columns.

Example The following example produces a double density, double speed graphic image of the pattern used in the standard density example. The amount of data must be doubled for double density (the data are used 54 times rather than 27).

```
10 WIDTH "lpt1:",255
20 LPRINT "Double Density Double Speed Bit Image Graphics"
30 LPRINT CHR$(27);"Y";CHR$(231);CHR$(1);
40 FOR N=1 TO 54
50 RESTORE
60 FOR I=1 TO 9
70 READ R
80 LPRINT CHR$(R);
90 NEXT I
100 NEXT N
110 LPRINT CHR$(255)
120 DATA 255,128,64,32,16,8,4,2,1
```

```
Double Density Double Speed Bit Image Graphics
```

Graphics, Quadruple Density

ASCII Code ESC Z *n1 n2*

Hex Code 1B 5A *n1 n2*

Dec Code 27 90 *n1 n2*

Purpose Selects Quadruple Density Bit Image graphics of 240 dpi horizontally and 72 dpi vertically.

Expression CHR$(27);"Z";CHR$(*n1*);CHR$(*n2*);"DATA"

where *(n1* + 256*n2)* defines the number of data bytes to follow.
DATA = ASCII characters for the dot pattern bytes.

NOTE: The DATA can be expressed in a CHR$(DATA) format with the appropriate decimal values of the ASCII characters supplied, especially in cases where the dot patterns of nonprintable characters are required.

NOTE: "DATA" consist of 8–bit dot columns, with the MSB at the top, and "1" bits producing dots. For more information, refer to Chapter 7.

Discussion This mode is similar to ESC L, except that four dot columns are printed in the space normally taken by two columns. You can change graphics density with the *ESC ?* command.

Example The following example produces quadruple density graphics of the pattern used in the standard density example. The amount of data must be quadrupled for quadruple density (the data are used 108 times rather than 27).

```
10 WIDTH "lpt1:",255
20 LPRINT "Quad Density Bit Image Graphics"
30 LPRINT CHR$(27);"Z";CHR$(205);CHR$(3);
40 FOR N=1 TO 108
50 RESTORE
60 FOR I=1 TO 9
70 READ R
80 LPRINT CHR$(R);
90 NEXT I
100 NEXT N
110 LPRINT CHR$(255)
120 DATA 255,128,64,32,16,8,4,2,1
```

```
Quad Density Bit Image Graphics
```

Half Speed Mode, On/Off

ASCII Code ESC s *n*

Hex Code 1B 73 *n*

Dec Code 27 115 *n*

Purpose Reduces printer speed 50%

where *n* = hex 00 or 30 turns half speed mode off
n = hex 01 or 31 turns half speed mode on

† Discussion This is simulated in your printer by unidirectional printing.

Horizontal Tab Execute

ASCII Code HT

Hex Code 09

Dec Code 09

Purpose Moves the logical print head to the next horizontal tab stop.

Discussion Power–on default horizontal tabs are set at every eighth character at the current character spacing. Tab positions are not affected by a change of font or character width. Blank spaces between HT stops are underlined in underline mode.

Horizontal Tab Set/Release

ASCII Code ESC D *n1* ... *nk* 0

Hex Code 1B 44 *n1* ... *nk* 00

Dec Code 27 68 *n1* ... *nk* 0

Purpose Sets up to 32 horizontal tab positions.

Expression CHR$(27);"D";CHR$(*n1*);...CHR$(*n32*);CHR$(0);
n = 1–255 ; *k* = 1–32

where *n1* through *n32* specify the character column of the tab positions. CHR$(0) is the sequence terminator. ESC D 0 clears all tabs.

Discussion The values of *n* must be listed in ascending order or they are ignored. Tabs greater than 32 or those positioned beyond the right margin are ignored. The physical tab position is the product of *n* and the current cell width (1/pitch), excluding double wide.

After the tabs are set, HT moves the logical print head to the next tab stop. Sending ESC @ initializes the printer and resets the tabs to every eighth character column (which is the default). In proportional mode, the size of 10 CPI characters determines tab positions.

Example The following example illustrates how to set horizontal tabs.

```
10 LPRINT "Control code"
20 LPRINT "ESC D CHR$(4);CHR$(10);CHR$(0)"
30 LPRINT "sets tab stops at columns 4 and 10."
40 LPRINT "Control code HT"
50 LPRINT "accesses the tab stops as follows:"
60 LPRINT CHR$(27);"D";CHR$(4);CHR$(10);CHR$(0);
70 LPRINT CHR$(9);
80 LPRINT "column 4"
90 LPRINT CHR$(9);CHR$(9);
100 LPRINT "column 10"
```

```
Control code
ESC D CHR$(4);CHR$(10);CHR$(0)
sets tab stops at columns 4 and 10.
Control code HT
accesses the tab stops as follows:
    column 4
           column 10
```

Initialize Printer

ASCII Code ESC @

Hex Code 1B 40

Dec Code 27 64

Purpose Resets all print–related parameters to values previously saved.

Discussion Restores the previously saved values and the print buffer is cleared of printable data on the line preceding the command. Current position is set as top–of–form.

Font, international language selection, forms length, skip–over perforation, and character pitch are reset to previously saved values. Other values are returned to default values.

Character–by–character and line–by–line attributes are canceled. All channels of the vertical format unit are cleared.

This command resets the horizontal tabs to every eighth character column. Interface parameters and printer protocol selection are not affected.

Italic Printing

ASCII Code ESC 4

Hex Code 1B 34

Dec Code 27 52

Purpose Turns on italic character printing.

Discussion Character graphics (IBM graphic set hex B0 through DF and F0 through FE) cannot be italicized. Italic printing will reduce throughput.

Italic Printing , Cancel

ASCII Code ESC 5

Hex Code 1B 35

Dec Code 27 53

Purpose Turns off italic character printing.

Line Feed

ASCII Code LF

Hex Code 0A

Dec Code 10

Purpose Prints the data in the buffer (if any) and advances the vertical character position a distance of one line at the current line spacing.

Discussion The logical print head keeps the same distance from the margin. The current line is printed and the logical printhead moves down a distance equal to the current line spacing. If there are no dots, paper moves and no printing occurs. When possible, successive line feeds are accumulated and moved at once.

This code cancels all one–line–only emphasis and font selections: double–wide from SO and ESC SO, and unidirectional printing from ESC <.

Line Feed *n*/216 Inch

ASCII Code ESC J *n*

Hex Code 1B 4A *n*

Dec Code 27 74 *n*

Purpose Immediately advances the paper n/216 inch.

where *n* = 0 through 255

Discussion *n* = 0 is ignored. Paper movement occurs in multiples of 3/216 inch. This command produces an immediate line feed but does not affect line spacing or produce a carriage return. Any one–line–only print attributes in effect are canceled.

Small values of *n* may result in overlapping lines. Overlapping lines may also occur if print attributes such as double high, superscript, or subscript characters are used on the same line.

Example The following example illustrates *n*/216–inch line spacing.

```
10 LPRINT "Control code ESC J 200
20 LPRINT CHR$(27);"J";CHR$(200);
30 LPRINT "performs a 200/216 inch"
40 LPRINT "line feed function for one line only."
```

```
Control code ESC J 200
```

```
performs a 200/216 inch
line feed function for one line only.
```

Line Spacing 1/6 Inch (6 lpi)

ASCII Code ESC 2

Hex Code 1B 32

Dec Code 27 50

Purpose Sets the line spacing to 1/6 inch for subsequent line feeds.

Discussion The 2 is ASCII *character* 2, not hex 2.

This control code overrides line spacing set at the operator panel.

Example The following example illustrates 1/6–inch line spacing.

```
10 LPRINT "Control code ESC 2 sets"
20 LPRINT CHR$(27);"2";
30 LPRINT "line spacing at"
40 LPRINT "6 lpi for all subsequent lines"
50 LPRINT "until reset or another spacing is selected."
```

```
Control code ESC 2 sets
line spacing at
6 lpi for all subsequent lines
until reset or another spacing is selected.
```

Line Spacing 1/8 Inch (8 lpi)

ASCII Code ESC 0

Hex Code 1B 30

Dec Code 27 48

Purpose Sets the line spacing to 1/8 inch (8 lpi) for subsequent line feeds.

Discussion When ESC 0 is received, all lines are printed at 8 lpi until a new line spacing is selected or power is reset. This control code overrides line spacing set at the operator panel.

Example The following example illustrates 1/8–inch line spacing.

```
10 LPRINT "Control code ESC 0 sets"
20 LPRINT CHR$(27);"0";
30 LPRINT "line spacing at"
40 LPRINT "1/8 (8 lpi) inch for all subsequent lines"
50 LPRINT "until reset or another spacing is selected."
```

```
Control code ESC 0 sets
line spacing at
1/8 (8 lpi) inch for all subsequent lines
until reset or another spacing is selected.
```

Line Spacing 7/72 Inch

ASCII Code ESC 1

Hex Code 1B 31

Dec Code 27 49

Purpose Sets the line spacing to 7/72 inch (10.3 lpi) for subsequent line feeds.

Discussion All lines are printed at the 7/72–inch line spacing until a new line spacing is selected or power is reset. This control code overrides line spacing set at the operator panel.

Printing speed is reduced if printed lines overlap.

Example The following example illustrates 7/72–inch line spacing.

```
10 LPRINT "Control code ESC 1 sets"
20 LPRINT CHR$(27);"1";
30 LPRINT "line spacing at"
40 LPRINT "7/72 inch for all subsequent lines"
50 LPRINT "until reset or another spacing is selected."
```

```
Control code ESC 1 sets
line spacing at
7/72 inch for all subsequent lines
until reset or another spacing is selected.
```

Line Spacing *n*/216 Inch

ASCII Code ESC 3 *n*

Hex Code 1B 33 *n*

Dec Code 27 51 *n*

Purpose Specifies the line spacing at *n*/216–inch increments.

where *n* = 0 through 255

Discussion All line feeds following receipt of this code are at *n*/216 inch line spacing until a new line spacing is selected or power is reset. Line spacing set by this control code overrides line spacing setting set at the operator panel.

The vertical character position moves only in multiples of the current dot row spacing. If the distance to move is other than a multiple of the current dot row spacing, the remainder is added to the next paper motion command.

Paper movement occurs in multiples of 3/216 only.

Use caution when combining this control code with other print attributes such as Elongated (Double High), Superscript, or Subscript; overlapping lines may occur. Print speed is reduced if lines overlap.

Example The following example illustrates *n*/216–inch line spacing.

```
10 LPRINT "Control code ESC 3 50 sets"
20 LPRINT CHR$(27);"3";CHR$(50);
30 LPRINT "line spacing at 50/216 inch"
40 LPRINT "increments for all subsequent lines"
50 LPRINT "until reset or another spacing is selected."
```

```
Control code ESC 3 50 sets
line spacing at 50/216 inch
increments for all subsequent lines
until reset or another spacing is selected.
```

Line Spacing *n*/72 Inch

ASCII Code ESC A *n*

Hex Code 1B 41 *n*

Dec Code 27 65 *n*

Purpose Sets a line spacing of *n*/72 inch for subsequent line feeds.

where *n* = 0 through 255

Discussion When this control sequence is received, all subsequent line feeds are *n*/72–inch until a new line spacing is selected or power is reset. This setting overrides line spacing set at the operator panel.

Small values of n may result in overlapping lines. Overlapping lines may also occur if print attributes such as Elongated (Double High), Superscript, or Subscript characters are used on the same line. If lines overlap, printing speed is reduced. Any values set by ESC 3 (line spacing n/216 inch) are replaced.

Example The following example illustrates 20/72–inch line spacing.

```
10 LPRINT "Control code ESC A 20 sets"
20 LPRINT CHR$(27);"A";CHR$(20);CHR$(27);"2";
30 LPRINT "line spacing at 20/72 inch"
40 LPRINT "increments for all subsequent lines"
50 LPRINT "until reset or another spacing is selected."
```

```
Control code ESC A 20 sets
line spacing at 20/72 inch

increments for all subsequent lines

until reset or another spacing is selected.
```

Make 80–9F Hex Control Codes

ASCII Code ESC 7

Hex Code 1B 37

Dec Code 27 55

Purpose Selects codes 80–9F hex in the character sets as control codes.

Discussion This is the default when the Epson character set is selected as the default set at the operator panel.

Make 80–9F Hex Printable

ASCII Code ESC 6

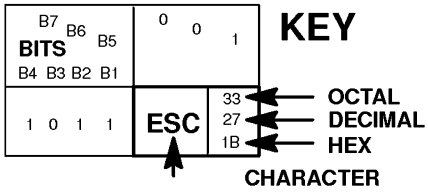
Hex Code 1B 36

Dec Code 27 54

Purpose Selects codes 80–9F in the character sets as hex printable characters.

Discussion This is the default when the IBM PC character set (code page 0437) is selected as the default set at the operator panel.

Figure 3–3 shows the 80–9F hex printable characters for the Epson character set, and for the IBM PC graphic character set.



B8 B7 B6 B5 BITS B4 B3 B2 B1	ROW	1 0 0 0 COLUMN 8		1 0 0 1 9	
0 0 0 0	0	à	200 128 80	§	220 144 90
0 0 0 1	1	è	201 129 81	ß	221 145 91
0 0 1 0	2	ù	202 130 82	Æ	222 146 92
0 0 1 1	3	ò	203 131 83	æ	223 147 93
0 1 0 0	4	ì	204 132 84	Ø	224 148 94
0 1 0 1	5	○	205 133 85	ø	225 149 95
0 1 1 0	6	£	206 134 86	¨	226 150 96
0 1 1 1	7	¡	207 135 87	Ä	227 151 97
1 0 0 0	8	¿	210 136 88	Ö	230 152 98
1 0 0 1	9	Ñ	211 137 89	Ü	231 153 99
1 0 1 0	10	ñ	212 138 8A	ä	232 154 9A
1 0 1 1	11	¤	213 139 8B	ö	233 155 9B
1 1 0 0	12	₧	214 140 8C	ü	234 156 9C
1 1 0 1	13	Å	215 141 8D	É	235 157 9D
1 1 1 0	14	å	216 142 8E	é	236 158 9E
1 1 1 1	15	ç	217 143 8F	¥	237 159 9F

Epson USA Character Set

B8 B7 B6 B5 BITS B4 B3 B2 B1	ROW	1 0 0 0 COLUMN 8		1 0 0 1 9	
0 0 0 0	0	Ç	200 128 80	É	220 144 90
0 0 0 1	1	ü	201 129 81	æ	221 145 91
0 0 1 0	2	é	202 130 82	Æ	222 146 92
0 0 1 1	3	â	203 131 83	ô	223 147 93
0 1 0 0	4	ä	204 132 84	ö	224 148 94
0 1 0 1	5	à	205 133 85	ò	225 149 95
0 1 1 0	6	å	206 134 86	û	226 150 96
0 1 1 1	7	ç	207 135 87	ù	227 151 97
1 0 0 0	8	ê	210 136 88	ÿ	230 152 98
1 0 0 1	9	ë	211 137 89	Ö	231 153 99
1 0 1 0	10	è	212 138 8A	Ü	232 154 9A
1 0 1 1	11	ï	213 139 8B	¢	233 155 9B
1 1 0 0	12	î	214 140 8C	£	234 156 9C
1 1 0 1	13	ì	215 141 8D	¥	235 157 9D
1 1 1 0	14	Ä	216 142 8E	₧	236 158 9E
1 1 1 1	15	Å	217 143 8F	ƒ	237 159 9F

IBM 437 Code Page

Figure 3–3. Epson Printable Codes (Hex 80–9F)

Master Print Select

ASCII Code ESC ! *n*

Hex Code 1B 21 *n*

Dec Code 27 33 *n*

Purpose Selects or changes print attributes in a single command.

where *n* = an 8–bit number with the bits set to specify print attributes, as shown below.

Bit No.	Bit = 0	Bit = 1
0	10 cpi	† 12 cpi
1	Monospaced	† Proportional
2	Normal	Condensed
3	Normal	Emphasized
4	Normal	† Double Strike
5	Normal	Double Wide
6	Normal	Italic
7	Normal	Underlined

† Discussion Emphasized is substituted for double strike. Graphics and grey scale characters are not underlined. Proportional spacing overrides condensed or 12 cpi printing if both are selected.

Paper Out Detection, Enable

ASCII Code ESC 9

Hex Code 1B 39

Dec Code 27 57

Purpose Asserts a paper out condition immediately when the end of the paper supply is sensed.

† Discussion The printer decodes and ignores this command.

Paper Out Detection, Disable

ASCII Code ESC 8

Hex Code 1B 38

Dec Code 27 56

Purpose Enable printing to the end of the paper supply when a paper out condition is sensed.

† Discussion The printer decodes and ignores this command.

Pass Bit 7 from Host

ASCII Code ESC #

Hex Code 1B 23

Dec Code 27 35

Purpose Passes bit 7 (the eighth and most significant bit) whether it is 1 or 0, thereby cancelling ESC > and ESC =.

Discussion This command affects only text and control code data; bit 8 of graphics data is always passed through.

Printer Select

ASCII Code DC1

Hex Code 11

Dec Code 17

Purpose Places printer in the selected state.

Discussion The configuration parameter Printer Select must be set to Enable. Refer to the *Setup Guide* for information about this menu option.

This control code allows the printer to receive and print data from the host if it was deselected by DC3. If the printer was not deselected by DC3, this code is ignored.

Printer Deselect

ASCII Code DC3

Hex Code 13

Dec Code 19

Purpose Places printer in the deselected state.

Discussion The configuration parameter Printer Select must be set to Enable. Refer to the *Setup Guide* for information about this menu option.

When the printer receives this command it ignores data until a DC1 (Printer Select) command is received.

Reassign Graphics Mode

ASCII Code ESC ? *s m*

Hex Code 1B 3F *s m*

Dec Code 27 63 *s m*

Purpose Changes one graphics mode to another.

Discussion *s* is character K, L, Y, or Z, which is changed to mode *m* (0–7) from Table 3–5 (page 3–50). Thereafter, sending data to the bit image command makes the data print according to the graphics mode you select with *m*.

Remove Downloaded Characters

ASCII Code ESC : 0 *n* 0

Hex Code 1B 3A 00 *n* 00

Dec Code 27 58 00 *n* 00

Purpose Erases all downloaded characters.

† Discussion The printer ignores this command but removes all data sent.

Select Graphics Mode

ASCII Code ESC * *m n1 n2*

Hex Code 1B 2A *m n1 n2*

Dec Code 27 42 *m n1 n2*

Purpose Turns on 8–pin bit image graphics mode *m*. Table 3–5 charts the graphics modes available.

Discussion The total number of columns = *n1* + 256*n2*.

NOTE: This command does not suppress hexadecimal 'FF' from printing.

Table 3–5. Epson Graphics Modes

m	Option	Alternate Code	Density * (dots per inch)	Resolution ** (dots per inch)
0	Single density	ESC K	60	120
1	Double density	ESC L	120	120 [1]
2	High–speed double density	ESC Y	60	120 [2]
3	Quadruple density	ESC Z	120	240 [1, 2, 3]
4	CRT I	none	80	160
5	Plotter (1:1)	none	72	144
6	CRT II	none	90	180
7	Double density plotter	none	144	144 [1]

[1] Prints at half speed.

[2] Data can be sent incorrectly. In these modes, no dots can be closer horizontally than the current font dot density. Sending incorrect data does not damage the printer.

[3] 240 DPI is simulated by combining the dots from two adjacent columns into one 120 DPI dot column.

* Number of horizontal dots per inch the printer can make.

** Number of dot columns available.

Select Italic Character Set

ASCII Code ESC t *n*

Hex Code 1B 74 *n*

Dec Code 27 116 *n*

Purpose Selects the italics characters from hex 80 through hex FF, or selects the graphics characters from hex 80 through hex FF.

where *n* = hex 1 selects the graphics character set
n = hex 0 selects the italics character set

Discussion The graphics character set is the IBM Graphics Code Page 437.

Select 9–Pin Graphics Mode

ASCII Code ESC ^ *m n1 n2 d1 ... dk*

Hex Code 1B 5E *m n1 n2 d1 ... dk*

Dec Code 27 94 *m n1 n2 d1 ... dk*

Purpose Turns on 9–pin bit image graphics mode.

Discussion *m* defines the plot density as shown in Table 3–5 on page 3–50.
n1 + 256*n2* = The total number of columns.

This mode requires two bytes of graphic data for every column of print. Each column is sent as a pair: *d1, d3, ... d(k–1)* set the top 8 bits of a normal dot column, just like ESC K; *d2, d4, ... dk* set the ninth dot in the column (the most significant bit) just below the bottom–most dot of columns *d1, d3, ... d(k–1)*.

Select Print Quality

ASCII Code ESC x *n*

Hex Code 1B 78 *n*

Dec Code 27 120 *n*

Purpose Selects print quality.

where *n* may be in the range from 0 to 4. Values in the range 5–255 are invalid.
n = hex 0 or hex 30 selects DP print quality
n = hex 1 or hex 31 selects Near Letter Quality (NLQ)
n = hex 2 or hex 32 selects Draft print quality
n = hex 3 or hex 33 selects OCR A print quality
n = hex 4 or hex 34 selects OCR B print quality

Discussion This command overrides operator panel print quality selections.

NOTE: Some print attributes (such as condensed, double-wide, etc.) may not return to their previous setting when changing from OCR-A or OCR-B back to another Print Quality. For guaranteed results, all print attributes should be set after the Print Quality is selected.

† Selecting an OCR print quality overrides any character attributes set, such as condensed, double–wide, etc.. Setting character attributes when OCR is set may cause unexpected results.

† Draft, OCR A, and OCR B print qualities (n = 2, 3, or 4) are not defined in Epson–FX printers.

Select/Deselect Proportional Spacing

ASCII Code ESC p *n*

Hex Code 1B 70 *n*

Dec Code 27 112 *n*

where *n* is an integer
n = 0 = Off
n = 1 = On

Purpose Turns proportional mode on and off.

Select Serif or Sans Serif Font

ASCII Code ESC k *n*

Hex Code 1B 6B *n*

Dec Code 27 107 *n*

Purpose Selects an NLQ font.

† **where** *if n* = 0, 2, 4 .. (any even value), the font selected is a serif NLQ font (Courier, instead of standard Epson Roman).

if n = 1, 3, 5 . (any odd value), the font selected is a sans serif NLQ font.

Select User–Defined Font

ASCII Code ESC % *n*

Hex Code 1B 25 *n*

Dec Code 27 37 *n*

Purpose Selects a user–defined font.

† **Discussion** The printer ignores this command and removes all font data sent from the data stream.

Select Vertical Tab Channel

ASCII Code ESC / *c*

Hex Code 1B 2F *c*

Dec Code 27 47 *c*

Purpose Selects a vertical tab channel set by ESC b.

where *c* = 0 through 7.

Discussion Subsequent VT (Hex 0B) commands use tab table specified by *c*. If no tab table is selected, channel 0 is used.

Set Absolute Horizontal Print Position in 1/60 Inch

ASCII Code ESC $ *n1 n2*

Hex Code 1B 24 *n1 n2*

Dec Code 27 36 *n1 n2*

Purpose Moves the logical print head to an absolute horizontal print position, using 1/60 inch increments.

where $\frac{(n1 + (256n2)}{60}$ = the unsigned distance in inches from the left margin.

Discussion If the distance goes beyond right margin, the sequence is ignored.

Set Bit 7 of Incoming Data Bytes to 1

ASCII Code ESC >

Hex Code 1B 3E

Dec Code 27 62

Purpose Sets the most significant bit (MSB) of all incoming data to 1.

Discussion The MSB is bit number 7. This command only affects text and control code data. Graphics data pass through unchanged.

Set Relative Horizontal Print Position in 1/120 Inch

ASCII Code ESC \ *n1 n2*

Hex Code 1B 5C *n1 n2*

Dec Code 27 92 *n1 n2*

Purpose Moves the logical print head to a relative horizontal print position, using 1/120 inch increments.

Discussion Adds (*n1* + 256*n2*)/120 inches to the horizontal position of the logical print head. The number sent is two's complement, with negative numbers moving to the left. The command is ignored if it would move the logical print head beyond the page margins.

Set Intercharacter Spacing in 1/120 Inch

ASCII Code ESC SP *n*

Hex Code 1B 20 *n*

Dec Code 27 32 *n*

Purpose Permits character spacing adjustments in 1/120 inch increments.

where *n* = 0 through 127.

Set Margin, Left

ASCII Code ESC l *n*

Hex Code 1B 6C *n*

Dec Code 27 108 *n*

where *n* = number of columns from the left edge of the physical page to the beginning of the print line; *n* = a hex value.

Purpose Sets the left margin to *n* columns in the current font.

Discussion Be sure to use the alphabetic lowercase "l" (as in left) rather than the numeral "1" (one) for this command. The number of inches of margin does not vary if the font, character width, or horizontal dot density changes. This command automatically clears and resets horizontal tabs to every eight characters. The smallest possible space between the left and right margins is the width of one double–wide, 10 cpi character. If a margin control code violates this minimum distance, it is ignored. Settings in proportional mode are treated as 10 CPI.

Set Margin, Right

ASCII Code ESC Q *n*

Hex Code 1B 51 *n*

Dec Code 27 81 *n*

where *n* = number of columns from the left edge of the physical page to the end of the print line; *n* = a hex value.

Purpose Sets the right margin to *n* columns at the current character width.

Discussion The number of inches of margin does not vary if the font, character width, or horizontal dot density changes. This command automatically clears and resets horizontal tabs to every eight characters. The smallest possible space between the left and right margins is the width of one–double wide, 10 cpi character. If a margin control code violates this minimum distance, it is ignored. Settings in proportional mode are treated as 10 CPI.

Set Forms Length by Lines

ASCII Code ESC C *n*

Hex Code 1B 43 *n*

Dec Code 27 67 *n*

Purpose Sets the form length by lines.

where *n* = hex 1 through hex C0 (decimal 1–192) to specify the number of lines per form at the current line spacing.

Discussion The forms length is set to the number of lines defined by the quotient of *n* divided by the current lines per inch so that the units are in inches.

The current line becomes the first line of the form. The forms length is always defined in inches; therefore, changing the lpi after this control code has been issued does not change the forms length.

If the calculated forms length in lines is not an exact multiple of the target machine dot size, the forms length value will be adjusted down to the next possible multiple.

When forms length is set by an ESC C sequence, the skip–over perforation set by ESC N is cancelled.

Set Form Length in Inches

ASCII Code ESC C 0 *n*

Hex Code 1B 43 30 *n*

Dec Code 27 67 48 *n*

Purpose Sets form length to *n* inches.

where *n* = whole numbers (hex values) from 1 through 24 to specify the number of inches on a form.

Discussion Upon receipt of this code, the current line becomes the first line of the form, and the form length set becomes the current forms length. Vertical tab positions set below the bottom of the form are ignored. Forms length is defined in inches; therefore, subsequent line spacing changes do not affect the result of this command.

Values of *n* greater than 24 are ignored.

When forms length is set by an ESC C sequence, the skip–over perforation set by ESC N is cancelled.

This control code overrides forms length set at the operator panel.

Set Vertical Tabs in Channels

ASCII Code ESC b *c n1 n2 n3 ... n16* 0

Hex Code 1B 62 *c n1 n2 n3 ... n16* 00

Dec Code 27 98 *c n1 n2 n3 ... n16* 0

Purpose Assigns vertical tabs to channels selected by ESC /.

where *c* = 0 through 7
n = 0 through 255
n1 through *nk* specify the line number for the vertical tab(s), up to a maximum of 16 tab positions. NUL must end the sequence.

Discussion Channels are selected by ESC /. The distance of each tab stop from TOF is the current line spacing times the number of lines given in *n*.

If paper movement is commanded to a value of *n* greater than the page length, the paper movement command is ignored. The values of *n* must be in ascending order. If they are not, the sequence up to and including the out of sequence number is ignored. The rest of the load is processed. Skip over perforation is ignored.

You can clear any channel by sending ESC b *c* 0, where *c* is the channel number.

Skip Over Perforation

ASCII Code ESC N *n*

Hex Code 1B 4E *n*

Dec Code 27 78 *n*

Purpose Selects the number of lines (at the current line spacing) for the paper to skip at the bottom of the page.

where *n* = 1 through 127

Discussion *n* is the number of lines skipped between the last line printed on one page and the first line on the next page. The actual distance set is the product of *n* and the current line spacing. If the value of *n* exceeds the current form length, the skip is set to one line smaller than the form length or to 0, whichever is greater.

Skip over perforation set by this command overrides operator panel settings. This feature is canceled by ESC O, ESC C, ESC C 0.

Skip Over Perforation, Cancel

ASCII Code ESC O

Hex Code 1B 4F

Dec Code 27 79

Purpose Cancels the skip over perforation set by ESC N and resets the bottom margin to zero.

Discussion O is ASCII uppercase o, not zero (0).

Superscript and Subscript Printing

ASCII Code ESC S *n*

Hex Code 1B 53 *n*

Dec Code 27 83 *n*

Purpose Selects superscript or subscript printing.

where *n* = NUL (hex 00) or 0 (hex 30) to enable superscript printing
n = SOH (hex 01) or 1 (hex 31) to enable subscript printing

† **Discussion** Superscript prints full–sized characters with a baseline higher than the normal characters. Subscript prints full–sized characters with a baseline lower than the normal characters. When the control code is received, all characters are superscript or subscript until reset by ESC T or printer reset. (This differs from the Epson standard, which utilizes half–size characters for superscript and subscript printing.)

You can print both superscript and subscript characters in the same character column by using the Backspace (BS) control code, but these characters will not print when double high printing is in effect.

If Superscript/Subscript is combined with Double High (ESC w) printing, *only* Double High printing will occur.

Example The following program illustrates superscript and subscript printing.

```
10 LPRINT "Control Code ESC S 0 selects";
20 LPRINT CHR$(27);"S";CHR$(0);" SUPERSCRIPT";CHR$(27);"T"
30 LPRINT "A";CHR$(27);"S";CHR$(0);"2";CHR$(27);"T";
40 LPRINT "+B";CHR$(27);"S";CHR$(0);"2";CHR$(27);"T";
50 LPRINT "=C";CHR$(27);"S";CHR$(0);"2";
60 LPRINT CHR$(27);"T"
70 LPRINT "Control Code ESC S 1 selects";
80 LPRINT CHR$(27);"S";CHR$(1);" SUBSCRIPT";CHR$(27);"T"
90 LPRINT "31";CHR$(27);"S";CHR$(1);"HEX";CHR$(27);"T";
100 LPRINT " 49 ";CHR$(27);"S";CHR$(1);"DEC";
110 LPRINT CHR$(27);"T"
120 LPRINT "Control Code ESC T cancels"
130 LPRINT "superscript/subscript printing."
```

```
Control Code ESC S 0 selects SUPERSCRIPT
A2+B2=C2
Control Code ESC S 1 selects SUBSCRIPT
31HEX 49 DEC
Control Code ESC T cancels
superscript/subscript printing.
```

Superscript and Subscript Printing, Cancel

ASCII Code ESC T

Hex Code 1B 54

Dec Code 27 84

Purpose Cancels superscript and/or subscript printing as set by ESC S *n*.

Underline

ASCII Code ESC – *n*

Hex Code 1B 2D *n*

Dec Code 27 45 *n*

Purpose Turns automatic underlining on and off.

where *n* = NUL or 0 (hex 00 or hex 30) to turn off underlining
n = SOH or 1 (hex 01 or hex 31) to turn on underlining

Discussion Spaces are underlined, but graphics and grey scale characters are not.

Example The following program illustrates underlining.

```
10 LPRINT "Control code ESC -1"
20 LPRINT CHR$(27);"-";CHR$(1);
30 LPRINT "enables automatic underlining."
40 LPRINT "Control code ESC -0"
50 LPRINT CHR$(27);"-";CHR$(0);
60 LPRINT "disables automatic underlining."
```

```
Control code ESC -1
enables automatic underlining.
Control code ESC -0
disables automatic underlining.
```

Unidirectional Printing, 1 Line

ASCII Code ESC <

Hex Code 1B 3C

Dec Code 27 60

Purpose Causes printing to occur from left to right for one line only.

Discussion Printing normally occurs in both directions of shuttle movement. This command causes the printer to print from left to right for one line. The command is cancelled by a CR.

Unidirectional Printing, Set/Reset

ASCII Code ESC U *n*

Hex Code 1B 55 *n*

Dec Code 27 85 *n*

Purpose Causes printing to occur in only one direction of shuttle movement (left to right).

where *n* = NUL or 0 (hex 00 or 30) turns unidirectional mode off
n = SOH or 1 (hex 01 or 31) turns unidirectional mode on

Discussion Printing normally occurs in both directions of shuttle movement. Unidirectional printing slows the printer down approximately 50%, but is sometimes used when very accurate dot placement is desired in graphics.

Vertical Tab, Execute

ASCII Code VT

Hex Code 0B

Dec Code 11

Purpose Advances the logical print head to the next vertical tab position selected by *ESC /*.

Discussion If no vertical channel was selected, channel 0 is used. If no vertical tabs were set, the paper advances one line.

The logical print head moves to the left margin. If a tab position is on the current line, the paper is moved to the next tab position. If there are no tab positions between the current line and the end of the form, the paper is moved to the top of the next form.

This code cancels all one–line–only emphasis and font controls: double–wide from SO and ESC SO, and unidirectional printing from ESC <.

Vertical Tab, Set/Clear

ASCII Code ESC B *n1 n2 n3...nk* NUL

Hex Code 1B 42 *n1 n2 n3...nk* 00

Dec Code 27 66 *n1 n2 n3...nk* 0

Purpose Sets up to 16 vertical tab positions.

where *n* = 1 through 255
k = 1 through 16
n1 through *nk* specify the line numbers for the vertical tab(s), up to a maximum of 16 tab positions. NUL must end the sequence.

To clear the tab settings, send ESC B NUL (1B 42 00).

Expression CHR$(27);"B";CHR$(*n1*);...CHR$(*nk*);CHR$(0);

Discussion The values of *n* range from 1 through 255 and must be in ascending order. The distance of each tab stop from TOF is the current line spacing times the number of lines given in *n*. If the value of *n* exceeds the form length, commands to move to that tab position are ignored.

If values of *n* are not in ascending order, the sequence up to and including the out–of–sequence number is ignored, and the rest of the load is processed. Skip over perforation is ignored.

This command always sets channel 0. You can clear channel 0 by sending ESC B 0. (See also the channel selection command, *ESC /*, and the channel loading command, *ESC b*.)

4 P–Series Printer Emulation

Chapter Contents

Overview

This chapter describes the P–Series emulation host control codes that are supported for the IBM 6400 ASCII printers. Emulation refers to the ability of a printer to execute the commands of a particular printer control language. A printer control language is the coding system used to convey, manipulate, and print data. Carriage Return, print quality, character attributes such as bold and underline, margins, and tabs are typical functions selected by printer control language codes. In this manual, the terms emulation, printer protocol, and printer control language are synonymous.

In P–Series emulation mode, the 6400 can print files coded for the P–Series printer control language. To select the P–Series emulation mode as the active printer configuration, refer to the ASCII Emulation Selection menu in Chapter 4 of the *IBM 6400 Line Matrix Printer Setup Guide* (S246–0116).

The P–Series emulation provides many configurable parameters. The default parameter values for this emulation are shown in Table 4–1. You can modify the emulation parameter values in two ways:

- **The P–Series host control codes.** An extensive set of P–Series control code commands can be sent to the printer from an attached host computer via the host data stream. Most of this chapter is devoted to describing the P–Series control code commands.
- **The printer configuration menus.** You can modify a subset of the P–Series emulation parameters using the operator panel switches and LCD display, as described in the *Setup Guide*.

Control codes sent from a host system generally override previous settings that result from the configuration menus. However, any configuration settings from host control codes will be gone once the printer is powered off (or reset to the default values), unless you have saved them to NVRAM using the configuration menus. The *Setup Guide* describes the Save Custom Sets option for saving changes to your printer's NVRAM.

The emulation's response to several of the control codes depends on the configuration. For example, upon receipt of the carriage return control code, the emulation will either perform a carriage return function only, or a carriage return and line feed, based on the configuration for the CR function.

P–Series Default Values and States

Your printer's onboard memory stores a set of typical operating states and conditions for the P–Series emulation. When you power on the printer and select this emulation, the default settings in Table 4–1 are automatically invoked.

Table 4–1. P–Series Default Settings

Characteristic	Default Setting
Character Sets	IBM PC
Print Language	ASCII (USA)
IBM PC	
Select Subset Primary	ASCII (USA)
Select Subset Extended	0437 PC Character Set
Multinational	ASCII (USA)
ECMA Latin 1	
Select Subset Primary	ASCII (USA)
Select Subset Extended	Multinational
DEC Multinational	ASCII (USA)
Control Code 06	8.0 LPI
Control Code 08	Elongated
Define CR Code	CR = CR
Auto LF	Disable
Overstrike	Enable
Define LF Code	LF = CR + LF
Select SFCC	1
EVFU Selected	Enable
Alternate Set 80–9F	Control Code

Table 4–2 lists several additional default settings for parameters that are provided by the Print Format menus (described in Chapter 4 of the *Setup Guide*). Many of the settings shown in Table 4–2 can be overridden by P–Series host control codes for the same parameter.

Table 4–2. Print Format Default Settings

Characteristic	Default Setting
CPI	10.0
LPI	6.0
Forms Width	Inches, 13.6 inches MM 345.4 mm Char. 136 characters
Forms Length	Inches 11.0 inches Millimeters 279 mm Lines 66 lines
Print Quality	DP Quality
Proportional Spacing	Disable
Italic Print	Disable
Slashed Zero	Disable
Left Margin	0 columns
Right Margin	0 columns
Bottom Margin	0 lines
Perforation Skip	Disable

Configuring the P–Series Emulation with Control Codes

The remainder of this chapter describes the P–Series printer control language codes that may be sent from a host computer attached to the printer, in order to invoke and configure numerous P–Series emulation functions.

Format for Control Code Descriptions

The following information is listed for each code function (where applicable).

Name The title or function of the command.

ASCII Code The ASCII mnemonic for the command is shown for the IBM 6400 ASCII printers, and the P-Series protocol. Command sequences are in 7-bit (ASCII) form.

Hex Code The code or command sequence in hexadecimal numbers.

Dec Code The code or command sequence in decimal numbers.

Expression The control codes used in the BASIC programming language (where applicable).

Purpose The function(s) of the control code.

Discussion A discussion of the uses of the code or command sequence, including exceptions or limitations to its use.

Example A sample written in BASIC programming language is provided for some control codes when it is possible to illustrate the effect of a control code, or if a specific syntax is required to complete the program statement (i.e. Horizontal Tab set, Vertical Tab set/clear). The programs in this chapter were run on an IBM Personal Computer using Microsoft** GW-BASIC** version 3.22.

IMPORTANT

All print samples in this chapter were run on an impact printer that has a dot resolution of 1/60–inch horizontally and 1/72–inch vertically.

WARNING: If you specify any parameters for a control code other than the ones that are defined in the control code description, unpredictable results may occur.

Special Function Control Code (SFCC) Header

A Special Function Control Code (SFCC) is used to extend the control code protocol. The SFCC is the control code introducer (or header); it is the first input in the sequence of parameters. The general control code sequence is:

(SFCC)(parameter 1)(parameter 2)...(parameter *n*)

P–Series codes can use SOH, ETX, ESC, ^ (hat) or ~ (tilde) as control code introducers. For example, bold print can be enabled in the P–Series protocol using any of the following control code introducers:

ASCII:	SOH G	**Hex:**	01 47	**Dec:**	01 71	**BASIC:**	CHR$(1);"G";
	ETX G		03 47		03 71		CHR$(3);"G";
	ESC G		1B 47		27 71		CHR$(27);"G";
	^ G		5E 47		94 71		CHR$(94);"G";
	~ G		7E 47		126 71		CHR$(126);"G";

NOTE: The SFCC has been set to ESC for all examples.

SFCC Command Line

Print format, print mode, or international language selection can be controlled by a longer sequence known as a command line. Command lines are string type commands placed between complete lines of text and affect the text which follows. The protocol has six command lines: PMODE, OSET, PSET, LPI, LINES, and INCHES. Each of these command lines is discussed in this chapter under the appropriate Control Code function.

For example, the forms length (in inches) can be set using the following command line:

SFCC INCHES; n. f

where: *n* is the whole number of inches, and *f* is the fractional increment in 0.5 inch increments.

When using the SFCC in a command line, the SFCC must be the first non–blank symbol in the line (space, hex 20, is a blank symbol). In addition, characters following spaces (other than a valid line terminator) in a command line are ignored so that user comments can be included on the command line. The valid line terminators are Form Feed (FF), Line Feed (LF), and Carriage Return (CR); however, when used in the command line,

these line terminators do *not* cause any paper motion. If a command line contains an error, the command will not be executed.

Attribute Set and Reset Codes

Certain print attributes are set and reset (turned on or off) by using the appropriate SFCC code sequence and the numbers 1 or 0. These may be either the hexadecimal code 01 and 00, or the ASCII code for the printable symbols of decimal 1 and 0 (hexadecimal code 31 and 30, respectively). Expanded Print, Super/Subscript Print, and Underline are attributes that are set/reset this way.

NUL Code

NUL (Hex 00) is ignored by the printer and can be used as a fill character; however, it can not be used to add blank spaces since it is not a space character.

NOTE: Hex '80' in the 0437 PC Character Set and Hex '7F' in the 0850 PC Character Set are treated as a NUL; however, these two controls can not be used as parameter terminators.

Print Modes Supported for Character Sets

Table 4–3 presents a summary of which print modes are supported for the P–Series emulation character sets. Additional information about character set support is provided under the heading "Notes." P–Series code pages for each character set in NLQ and Draft modes are provided in Appendix F.

Table 4–3. Character Set Print Mode Support

Character Set	NLQ	DP	Draft	Notes
IBM PC, Primary Subset ASCII (USA) French German English (UK) Danish Swedish Italian Spanish Japanese French Canadian Latin American Danish II Spanish II Latin American II	X	X	X	The print mode support is the same for all of the IBM PC Primary Subset languages.
IBM PC, Extended Subset 0437 IBM PC 0850 PC Multilingual	X	X	X	The print mode support is the same for both Extended character sets.
Multinational ASCII (USA)	X	X	X	
Multinational EBCDIC	X	X	X	
ECMA Latin I, Primary Subset ASCII (USA) German Swedish Danish Norwegian Finnish English (UK) Dutch French Spanish Italian Turkish Japanese	X	X	X	The print mode support is the same for all of the ECMA Latin I Primary Subset languages.
				continued next page

Table 4–3. Character Set Print Mode Support *(continued)*

Character Set	NLQ	DP	Draft	Notes
ECMA Latin I, Extended Subset Barcode 10 CPI Multinational DP 10 CPI Multinational DP 12 CPI Multinational NLQ 10 CPI Greek DP 10 CPI Greek DP 12 CPI Greek NLQ 10 CPI Graphic DP 10 CPI Graphic NLQ 10 CPI Scientific DP 10 CPI Scientific DP 12 CPI Scientific NLQ 10 CPI	N/A	N/A	N/A	These character sets are guaranteed readable only in the Print Quality and Print Density specified.
DEC Multinational French German English (UK) Norwegian / Danish Swedish Italian Spanish Japanese French Canadian Dutch Finnish Swiss	X	X	X	The print mode support is the same for all of the DEC Multinational languages.
OCR–A / OCR–B	N/A	N/A	N/A	Only 10 cpi OCR is supported.

The Control Codes

This index lists each printer command by function, ASCII mnemonic, and the page where the command is explained in detail. "N/A" means not applicable. The rest of this chapter defines the control code functions for P–Series Emulation mode. The commands are listed in alphabetical order.

NOTE: Some control code functions can be accomplished using another control code sequence or via operator panel selection.

FUNCTION	ASCII CODE	PAGE
Print Attributes *(continued)*		
Elongated (Double High) Print (1 line)	SFCC h	4–23
Emphasized Print	SFCC E	4–24
Emphasized Print Reset	SFCC F	4–25
Expanded (Double Wide) Print	SFCC W	4–26
Expanded (Double Wide) Print Reset	SFCC W	4–26
Expanded (Double Wide) Print (1 line)	SFCC k	4–27
Overscoring	SFCC _	4–41
Print Mode/Pitch Selection	SFCC X SFCC PMODE SFCC [nq	4–43
Superscript/Subscript Printing	SFCC S	4–47
Superscript/Subscript Printing Reset	SFCC T	4–48
Underline	SFCC –	4–49
Graphics		
Plot, Even Dot (High Density)	EOT SFCC d	4–42
Plot, Odd Dot (Normal Density)	ENQ SFCC e	4–43
Other Functions		
Bell	BEL	4–12
Character Set Select	SFCC l	4–16
Characters 80–9F (Control Codes)	SFCC 7	4–19
Characters 80–9F (Printable Symbols)	SFCC 6	4–16
Character Set Select: ECMA Extended	SFCC OSET	4–20
Character Set Select: International Languages	SFCC R SFCC PSET	4–21
Extended Character Set	SO SFCC SO SFCC n SFCC 4	4–28
Extended Character Set Cancel	SI SFCC SI SFCC o SFCC 5	4–29
Emulation Reset	SFCC @	4–25

Backspace

ASCII Code BS

Hex Code 08

Dec Code 08

Purpose Moves the logical print head to the left one character space toward the first character column.

Discussion When configured from the operator panel for backspace, BS moves the character position indicator (the logical print head position) one character space to the left at the current character pitch setting. The code is ignored if the logical print head is positioned at the first character column.

Example Print and backspace two character positions.

```
10 LPRINT "TTTTT";
20 LPRINT CHR$(8);CHR$(8);
30 LPRINT "=="


TTT==
```

Bell

ASCII Code BEL

Hex Code 07

Dec Code 07

Purpose Sounds the printer's buzzer/beeper.

Discussion The BEL function will sound the buzzer/beeper for 0.2 seconds upon receipt of this command.

Bold Print

ASCII Code	SFCC G	SFCC j
Hex Code	SFCC 47	SFCC 6A
Dec Code	SFCC 71	SFCC 106

Purpose Selects bold character printing.

Discussion When the bold character printing control code is received, all characters are printed in bold until reset by the bold print reset control code or printer reset. Bold Print is the same as printing double strike.

When SFCC j is used, bold printing is selected for one line only and reset by the bold print reset control code, emulation reset, or a paper motion command.

Example The following sample program illustrates bold character printing.

```
10 LPRINT "Control code ESC G"
20 LPRINT CHR$(27);"G";
30 LPRINT "selects bold character printing,"
40 LPRINT "for example: AaBbCcDdEeFfGgHhIiJjKkLlMmNnOoPp."
50 LPRINT "Control code ESC H"
60 LPRINT CHR$(27);"H";
70 LPRINT "cancels bold character printing."
```

```
Control code ESC G
selects bold character printing,
for example: AaBbCcDdEeFfGgHhIiJjKkLlMmNnOoPp.
Control code ESC H
cancels bold character printing.
```

Bold Print Reset

ASCII Code SFCC H

Hex Code SFCC 48

Dec Code SFCC 72

Purpose Resets bold character printing.

Discussion The Bold Print Reset control code only resets the bold print character attribute. Other print attributes such as double wide printing are not affected.

Example Refer to the Bold Print control code for a sample program of bold character print set and reset.

Carriage Return

ASCII Code CR

Hex Code 0D

Dec Code 13

Purpose Returns the logical print head to the first character column (resets the pointer to the first character position).

Discussion The CR code may or may not cause printing or paper motion, depending on the Define CR Code value defined in the configuration menus. If the Define CR Code submenu displays:

```
Define CR Code
CR = CR
```

The characters following the CR are printed over the previous characters on the line. If identical characters are placed in the same position on the line, those characters will be printed in bold (double strike) print when the Overstrike mode is enabled from the operator panel.

The CR=CR configuration causes subsequent printable data to overprint previous data at half speed if Overstrike is enabled from the operator panel (and prints somewhat faster if Overstrike is disabled), unless an intervening paper motion command is received.

If the Define CR Code submenu displays:

```
Define CR code
CR = CR+LF
```

Control code CR is converted to perform a carriage return and line feed function.

Character Set Select

ASCII Code SFCC 1 *xyz* (lowercase L)

Hex Code SFCC 6C *xyz*

Dec Code SFCC 76 *xyz*

Purpose Selects the character set, extended character set, and the international language for a specific character set.

Expression CHR$(27);"l";CHR$(*x*);CHR$(*y*);CHR$(*z*);

where *x* is the character set (Table 4–4);

y is the international language for the selected character set (Table 4–5);

z is the extended character set for the selected character set (Table 4–6);

Discussion If the asterisk (*) is the value selected for ***x***, the character set will not change. If * is the value selected for ***y*** or ***z***, the previously selected international language and/or extended character set for the selected character set will be used.

If X is the value selected for ***y***, the primary language will access the downloaded character substitution table defined by SFCC V for the selected character set.

The character set, international language and extended character set can also be selected from the printer operator panel, via the Character Set and Print Language options; however, the control code setting will override the operator panel selection. Except for the asterisk and X values discussed above, values other than those shown in the tables will result in the control sequence being terminated.

Appendix F provides print samples for each character set, shown in NLQ and Draft print modes. A table on page 4–7 provides detailed notes on print mode support for each character set.

Table 4–4. Character Set Select (*x*)

x	Character Set
0(30)	IBM PC
1(31)	Multinational
2(32)	ECMA 94 Latin 1
3(33)	DEC Multinational

Table 4–5. International Language Select (*y*)

y	x 0(30)	1(31)	2(32)	3(33)
	IBM PC	**Multinational**	**ECMA 94 Latin 1**	**DEC Multinational**
0(30)	ASCII (USA)	ASCII (USA)	ASCII (USA)	ASCII (USA)
1(31)	French	EBCDIC	German	French
2(32)	German		Swedish	German
3(33)	English (UK)		Danish	English (UK)
4(34)	Danish		Norwegian	Norwegian/Danish
5(35)	Swedish		Finnish	Swedish
6(36)	Italian		English (UK)	Italian
7(37)	Spanish		Dutch	Spanish
8(38)	Japanese		French	Japanese
9(39)	French Canadian		Spanish	French Canadian
10(3A)	Latin American		Italian	Dutch
11(3B)	Danish–II		Turkish	Finnish
12(3C)	Spanish–II		Japanese	Swiss
13(3D)	Latin American–II			

Table 4–6. Extended Character Set Select (*z*)

	x	0(30)	1(31)	2(32)	3(33)
z		**IBM PC**	**Multinational**	**ECMA 94 Latin 1**	**DEC Multinational**
0(30)		IBM PC (0437)	Multinational Extended Set	Barcode 10 cpi	DEC Multinational Extended Set
1(31)		IBM PC (0850)		Multinational DP 10 cpi	
2(32)				Multinational DP 12 cpi	
3(33)				Multinational NLQ 10 cpi	
4(34)				Greek DP 10 cpi	
5(35)				Greek DP 12 cpi	
6(36)				Greek NLQ 10 cpi	
7(37)				Graphics DP 10 cpi	
8(38)				Graphics NLQ 10 cpi	
9(39)				Scientific DP 10 cpi	
10(3A)				Scientific DP 12 cpi	
11(3B)				Scientific NLQ 10 cpi	
12(3C)				Multinational (at Primary set mode and pitch)	

Characters 80–9F (Control Codes)

ASCII Code SFCC 7

Hex Code SFCC 37

Dec Code SFCC 55

Purpose Selects hex codes 80 to 9F in the character sets as control codes. Cancels the command SFCC 6.

Discussion This control code overrides the operator panel setting (described in Chapter 4 of the *Setup Guide*).

Characters 80–9F (Printable Symbols)

ASCII Code SFCC 6

Hex Code SFCC 36

Dec Code SFCC 54

Purpose Selects hex codes 80 to 9F in the character sets as printable symbols. Cancels the command SFCC 7.

Discussion This control code overrides the operator panel setting (described in Chapter 4 of the *Setup Guide*).

Appendix F shows the printable symbols for columns 80 to 9F.

Character Set Select: ECMA 94 Latin 1 Extended

ASCII Code SFCC OSET; *n*

Purpose Selects the print mode and pitch at which the extended characters will print. Valid only if the ECMA 94 Latin 1 Extended Character Set is selected; otherwise, this command is ignored.

Discussion *n* ranges from 0 to 12 to select the print mode/pitch combinations available from Table 4–1. All other values will result in an error message.

OSET is valid *only* when the ECMA 94 Latin 1 character set has been selected from the operator panel. OSET will be ignored if the IBM PC, Multinational, or DEC Multinational Character Sets are active.

Extended characters will print at the print mode and pitch selected by the OSET command, even if that mode and pitch differs from the currently selected print mode and pitch. If the print mode differs between the extended and primary characters, the first character in the data stream selects the print mode at which that line will print. Different pitches can be printed on the same line.

Table 4–1. Print Modes/Pitches Available Using P–Series OSET (ECMA 94 Latin 1, Extended Character Set Only)

n	Print Mode/Pitch Select
0	Bar Code DP 10 cpi
1	Multinational DP 10 cpi
2	Multinational DP 12 cpi
3	Multinational NLQ 10 cpi
4	Greek DP 10 cpi
5	Greek DP 12 cpi
6	Greek NLQ 10 cpi
7	Graphics DP 10 cpi
8	Graphics NLQ 10 cpi
9	Scientific DP 10 cpi
10	Scientific DP 12 cpi
11	Scientific NLQ 10 cpi
12	Multinational at Primary Character Set Mode and Pitch

Character Set Select: International Languages

ASCII Code SFCC PSET;*n* SFCC R*n*

Hex Code SFCC 52 *n*

Dec Code SFCC 82 *n*

Purpose Specifies the international language set identified by "*n*" in the basic character set selected from the operator panel (ECMA–94 Latin 1, IBM PC, Multinational, and DEC Multinational). Refer to Appendix F for individual character set charts.

where *n* specifies a language, as shown in Table 4–7.

Table 4–7. International Character Sets

n		Character Set Selected			
SFCC/ ESC R (hex)	**PSET**	**ECMA 94 Latin 1**	**IBM PC (0437 or 0850)**	**Multinational**	**DEC Multinational**
0(30)	0	ASCII (USA)	ASCII (USA)	ASCII (USA)	ASCII (USA)
1(31)	1	German	French	EBCDIC	French
2(32)	2	Swedish	German		German
3(33)	3	Danish	English (UK)		English (UK)
4(34)	4	Norwegian	Danish		Norwegian/Danish
5(35)	5	Finnish	Swedish		Swedish
6(36)	6	English (UK)	Italian		Italian
7(37)	7	Dutch	Spanish		Spanish
8(38)	8	French	Japanese		Japanese
9(39)	9	Spanish	French Canadian		French Canadian
0A(3A)	10	Italian	Latin American		Dutch
0B(3B)	11	Turkish	Danish–II		Finnish
0C(3C)	12	Japanese	Spanish–II		Swiss
0D(3D)	13		Latin American–II		
0E(3E)	14	*(currently undefined)*			
0F(3F)	15				
10(40)	16				
11(41)	17				
12(42)	18				
13(43)	19				
14(44)	20				
15(45)	21				

Character Set Select: International Languages (continued)

Discussion The international character set can also be selected from the operator panel via the Print Language option; however, the control code setting will override the operator panel character set selection. Values other than those selectable from Table 4–7 will be ignored.

Appendix F provides print samples for each character set, shown in NLQ and Draft print modes. A table on page 4–7 provides detailed notes on print mode support for each character set.

Example The following example illustrates international character selection using the IBM PC character set.

```
10 LPRINT "Control code ESC R 5 selects"
20 LPRINT "the Swedish character set shown beneath"
30 LPRINT "the USA (ASCII) characters."
40 LPRINT
50 LPRINT "A B C D [ \ ] ^ _ ` { | } ~"
60 LPRINT CHR$(27);"R";CHR$(5);
70 LPRINT "A B C D [ \ ] ^ _ ` { | } ~"
80 LPRINT CHR$(27);"R";CHR$(0);
```

```
10 LPRINT "Control code ESC R 5 selects"
20 LPRINT "the Swedish character set shown beneath"
30 LPRINT "the USA (ASCII) characters."
40 LPRINT
50 LPRINT "A B C D [ \ ] ^ _ ` { | } ~"
60 LPRINT CHR$(27);"R";CHR$(5);
70 LPRINT "A B C D [ \ ] ^ _ ` { | } ~"
80 LPRINT CHR$(27);"R";CHR$(0);
```

```
Control code ESC R 5 selects
the Swedish character set shown beneath
the USA (ASCII) characters.

A B C D [ \ ] ^ _ ` { | } ~
A B C D Ä ö Å Ü _ é ä ö å ü
```

Elongated (Double High) Print , 1 Line Only

ASCII Code	SFCC h	BS
Hex Code	SFCC 68	08
Dec Code	SFCC 104	08

Purpose Selects elongated (double high) character printing for one line only. Elongated characters are approximately double height but standard width.

Discussion The elongated character control code is a line–by–line print attribute; when the control code is received, one entire line of elongated characters is printed and then automatically reset.

When configured for double high print, the P–Series control code BS (Hex 08) also selects elongated character printing for a single line.

When using this feature with relative line slewing, the paper will be moved *n* + 1 lines rather than *n* lines. Refer to Chapter 8 (Vertical Page Formatting) for more information on relative line slewing. When using small line spacing and the lines overlap, an unexpected print format may result.

Example The following sample program illustrates elongated character printing.

```
10 LPRINT "Control code"
20 LPRINT "ESC h selects"
30 LPRINT CHR$(27);"h";
40 LPRINT "elongated character printing"
50 LPRINT "for one line only."
```

```
Control code
ESC h selects
elongated character printing
for one line only.
```

Emphasized Print

ASCII Code SFCC E

Hex Code SFCC 45

Dec Code SFCC 69

Purpose Selects emphasized character print format.

Discussion When the emphasized print control code is received, all characters will be printed in emphasized print until reset by the emphasized print reset control code or printer reset. The emphasized print attribute is implemented by horizontal "shadow" printing.

Emphasized print is ignored during superscript or subscript printing, and when 15–20 cpi characters have been selected.

Example The following sample program illustrates emphasized character printing.

```
10 LPRINT "Control code"
20 LPRINT "ESC E selects"
30 LPRINT CHR$(27);"E";
40 LPRINT "emphasized character printing."
42 LPRINT "Control code ESC F"
50 LPRINT CHR$(27);"F";
60 LPRINT "cancels emphasized character printing."
```

```
Control code
ESC E selects
emphasized character printing.
Control code ESC F
cancels emphasized character printing.
```

Emphasized Print Reset

ASCII Code SFCC F

Hex Code SFCC 46

Dec Code SFCC 70

Purpose Resets emphasized character printing.

Discussion The emphasized print reset control code only resets the emphasized print character attribute.

Example See the Emphasized Print control code example for an example of Emphasized Print Reset.

Emulation Reset

ASCII Code SFCC @

Hex Code SFCC 40

Dec Code SFCC 64

Purpose Initializes all print mode related parameters to values previously saved.

Discussion Print mode, line spacing, international language selection, margins, form length, skip–over perforation, and character pitch are reset to previously saved values. Character–by–character and line–by–line attributes are canceled. The vertical format unit is cleared. The current line is set to the top–of–form position. Interface parameters and printer protocol selection are not affected.

Expanded Print (Double Wide)

ASCII Code SFCC W *n*

Hex Code SFCC 57 *n*

Dec Code SFCC 87 *n*

Purpose Selects or resets expanded (double wide) print.

where *n* = 1 selects expanded print (hex 01 or hex 31)
n = 0 resets expanded print (hex 00 or hex 30)

Discussion When expanded print using SFCC W is received, all characters will be printed double wide until reset by the expanded print reset control code or a printer reset.

Example The following sample program illustrates expanded character printing and expanded character printing reset.

```
10 LPRINT "Control code"
20 LPRINT "ESC W 1 selects"
30 LPRINT CHR$(27);"W";CHR$(1);
40 LPRINT "expanded character printing."
50 LPRINT "Control code"
60 LPRINT "ESC W 0 resets"
70 LPRINT CHR$(27);"W";CHR$(0);
80 LPRINT "expanded character printing."
```

```
Control code
ESC W 1 selects
e x p a n d e d   c h a r a c t e r   p r i n t i n g .
Control code
ESC W 0 resets
expanded character printing.
```

Expanded Print (Double Wide), 1 Line Only

ASCII Code SFCC k

Hex Code SFCC 6B

Dec Code SFCC 107

Purpose Selects expanded (double wide) print for one line only.

Discussion This expanded print control code is a line–by–line print attribute; when the SFCC k control code is received, the current line is printed double wide and then automatically reset.

This control code can be reset by a paper motion control code (LF, VT, CR, etc.), SFCC @ (printer reset), CAN or SFCC W (double wide print).

Example The following sample program illustrates Expanded Print for one line only. Another example of expanded printing is shown for Expanded (Double Wide) Print, SFCC W on page 4–26.

```
10 LPRINT "Control code"
20 LPRINT "SO selects"
30 LPRINT CHR$(14);
40 LPRINT "expanded character printing"
50 LPRINT "for one line only."
```

```
Control code
SO selects
expanded character printing
for one line only.
```

Extended Character Set

ASCII Code	SO (Shift Out)	SFCC SO SFCC *n* SFCC 4
Hex Code	0E	SFCC 0E SFCC 6E SFCC 34
Dec Code	14	SFCC 14 SFCC 110 SFCC 52

Purpose Accesses the extended character set in the range A0 to FF hex using codes 20 to 7F hex.

Discussion Used in 7–bit systems as if data bit 8 was set to 1. For example, sending code 20 hex accesses the symbol at code point A0 hex. If a printable symbol is not available at the code point, a space is printed.

SFCC 4 is not cancelled by the next paper motion command; SO, SFCC SO, SFCC *n* are cancelled by paper motion. Refer to the character set charts in Appendix F.

Example The following sample program illustrates the Extended Character Set and Extended Character Set Cancel (see page 4–29) control codes.

```
10 LPRINT "Control code"
20 LPRINT "ESC 4 selects the extended character set"
30 LPRINT "and ESC 5 selects the primary character set"
40 LPRINT "which is displayed beneath the extended character set."
50 LPRINT
60 LPRINT CHR$(27);"4";
70 LPRINT "ABCDEFGH"
80 LPRINT CHR$(27);"5"
90 LPRINT "ABCDEFGH"
```

```
Control code
ESC 4 selects the extended character set
and ESC 5 selects the primary character set
which is displayed beneath the extended character set.

ABCDEFGH
```

Extended Character Set Cancel (Primary Set Select)

ASCII Code	SI (Shift In)	SFCC SI SFCC o SFCC 5
Hex Code	0F	SFCC 0F SFCC 6F SFCC 35
Dec Code	15	SFCC 15 SFCC 111 SFCC 53

Purpose Cancels Extended Character Set as selected by SO, SFCC SO, SFCC *n*, and SFCC 4, and selects the Primary Character Set.

Discussion Used in 7–bit systems. If data bit 8 is disabled, this control code selects the range as if data bit 8 is set to 0, and data is printed as characters from 20 to 7F hex.

Example Refer to the Extended Character Set example on the previous page.

Form Feed

ASCII Code FF

Hex Code 0C

Dec Code 12

Purpose Prints the data in the buffer, advances the paper position to the next top–of–form and moves the character position to the first character column.

Discussion The default forms length is determined by the printer's configuration. Forms length is set by using the operator panel or forms length control codes. Code FF cancels all single–line only print attributes.

The default form length is 11 inches. The Form Feed command will react differently when the VFU is active. Refer to Chapter 8 (Vertical Page Formatting).

Forms Length Set (Inches)

ASCII Code SFCC INCHES; *n.f*

Purpose Sets the length of forms (paper) in inches.

where *n* = whole numbers from 1 to 24 to specify the number of inches on a page.

f = fractional number in .5–inch increments (minimum forms length is .5 inches).

Discussion Upon receipt of this code, the current line becomes the first line of the form, and the form length set becomes the current forms length. Vertical tab positions set below the bottom of the form are cleared.

Forms length is defined in inches; therefore, subsequent line spacing changes do not affect the result of this command. Increments of .5–inch can be specified; for example, sending the following command will result in a form length setting of 7–1/2 inches: SFCC INCHES; 7.5

The maximum forms length is 24 inches. All other values are ignored. In INCHES mode, incorrect values will produce an error message.

Forms length can also be set by the operator panel. The control code forms length setting from the host computer will override the operator panel setting. However, if the VFU is enabled and loaded, this command is ignored.

Forms Length Set (Lines)

ASCII Code SFCC LINES; *n*

Purpose Sets the length of a form (paper) in lines.

where *n* = 1 to 192 (P–Series) to specify the number of lines per page at the current line spacing.

Discussion The forms length is set to the number of lines defined by the quotient of *n* and the current line spacing so that the units are in inches. In LINES mode, the maximum form length is 24 inches, and *n* values in excess of 24 inches will cause an error message.

If the calculated forms length in lines is not an exact multiple of the target machine dot size, the forms length value will be adjusted down to the next possible multiple.

If the VFU is enabled and loaded, this command is ignored.

Form Margins, Set

ASCII Code SFCC v *n1 n2 n3 n4*

Hex Code SFCC 76 *n1 n2 n3 n4*

Dec Code SFCC 118 *n1 n2 n3 n4*

Purpose Selects left (*n1*), right (*n2*), top (*n3*), and bottom (*n4*) form margins.

where *n1* = The width of the left margin (hex value) in character columns at the current cpi. If the requested margin is larger than the current (form width–right margin), the value is ignored.

n2 = The width of the right margin (hex value) in character columns at the current cpi. If the requested margin is larger than the current (form width–left margin), the value is ignored.

n3 = The length of the top margin (hex value) in character lines at the current lpi. If the requested margin is larger than the current (form length–bottom margin), the value is ignored.

n4 = The length of the bottom margin (hex value) in character lines at the current lpi. If the requested margin is larger than the current (form length–top margin), the value is ignored.

Discussion A hex value of FF for *n1*, *n2*, *n3*, or *n4* indicates that the margin remains unaffected.

When set, the right and bottom margins take effect immediately; the left margin takes effect for the current line only if no horizontal motion has occurred for the line, otherwise it takes effect on the next line. The top margin always takes effect on the next form.

Vertical tabs defined within the top and bottom margins are ignored. Horizontal tabs are offset by the left margin and ignored within the right margin.

Line Feed

ASCII Code LF

Hex Code 0A

Dec Code 10

Purpose Prints the data in the buffer (if any) and advances the vertical character position one line at the current line space setting.

Discussion If configured for LF equals new line (LF=CR+LF), the logical print head is positioned at character column 1 of the new line. Otherwise, the logical print head does not move when configured for LF function only (LF=LF ONLY). The LF function cancels all single line print attributes such as double high (elongated) and double wide (expanded) characters.

This code is always configured for LF=CR+LF in the P–Series protocol.

In the P–Series Even Dot Plot mode (high density graphics), the LF code does not cause paper position motion; the data in the buffer is plotted and the logical print head is positioned at character column 1 in anticipation of the Odd Dot Plot control code to complete high density graphic plotting.

In the P–Series Odd Dot Plot mode (normal density graphics), the LF code plots the data in the buffer, advances the paper position a single dot row at the current vertical dot density, and positions the logical print head at character column 1.

Line Spacing 1/6 Inch (6 lpi)

ASCII Code SFCC LPI ; *n*

SFCC A *n*
SFCC 2

Hex Code

SFCC 41
SFCC 32

Dec Code

SFCC 65
SFCC 50

Purpose Sets line spacing to 6 lpi or as set by SFCC A.

Discussion For SFCC LPI ; *n*, the value of *n* can be 6 or 8 only. If *n* = 6, this command sets line spacing to 1/6 inch. Values of *n* other than 6 or 8 will cause an error message.

SFCC/ESC 2 asserts *n*/72–inch line spacing as set by SFCC/ESC A (page 4–39). If no distance has been set by SFCC/ESC A, the distance is 1/6 inch.

The control code line spacing selection will override the operator panel line spacing setting.

Example The following example illustrates 1/6–inch line spacing and assumes that a distance has not been set by ESC A.

```
10 LPRINT "Control code ESC 2 sets"
20 LPRINT CHR$(27);"2";
30 LPRINT "line spacing at"
40 LPRINT "6 lpi for all subsequent lines"
50 LPRINT "until reset or another spacing is selected."
```

```
Control code ESC 2 sets
line spacing at
6 lpi for all subsequent lines
until reset or another spacing is selected.
```

Line Spacing 1/8 Inch (8 lpi)

ASCII Code	SFCC LPI ; *n*	SFCC 0
Hex Code		SFCC 30
Dec Code		SFCC 48

Purpose Specifies continuous line spacing at 1/8–inch increments (8 lpi).

Discussion When the 1/8–inch line spacing control code is received, all lines will be printed at 8 lpi until a new line spacing is selected or power is reset. The control code line spacing selection will override the operator panel line spacing setting.

For SFCC LPI ; *n*, the value of *n* can be 6 or 8 only. If *n* = 8, this command sets line spacing to 1/8 inch. Values of *n* other than 6 or 8 will cause an error message.

Example The following example illustrates 1/8–inch line spacing.

```
10 LPRINT "Control code ESC 0 sets"
20 LPRINT CHR$(27);"0";
30 LPRINT "line spacing at"
40 LPRINT "1/8 (8 lpi) inch for all subsequent lines"
50 LPRINT "until reset or another spacing is selected."
```

```
Control code ESC 0 sets
line spacing at
1/8 (8 lpi) inch for all subsequent lines
until reset or another spacing is selected.
```

Line Spacing 8 or 10.3 lpi (1 Line Only)

ASCII Code	ACK	SFCC f
Hex Code	06	SFCC 66
Dec Code	06	SFCC 102

Purpose Selects line spacing of 8 or 10.3 lpi for the current line only.

Discussion The default line spacing is reselected automatically after one line. Line spacing may be selected either through the operator panel or by line spacing control codes. The control code setting will override the operator panel line spacing setting.

If the alternate line spacing selected from the operator panel is 8 lpi, the ACK control code will set the line spacing to 8 lpi. If 10.3 lpi was selected from the operator panel, the ACK control code will set the line spacing to 10.3 lpi (7/72").

Example The following example illustrates printing a single line of text at 8 lpi.

```
10 LPRINT "Control code ACK"
20 LPRINT "selects 8 lpi line spacing"
30 LPRINT CHR$(6);"for one line only."
40 LPRINT "The default line spacing is"
50 LPRINT "then reselected automatically."
```

```
Control code ACK
selects 8 lpi line spacing
for one line only.
The default line spacing is
then reselected automatically.
```

Line Spacing 7/72 Inch

ASCII Code SFCC 1

Hex Code SFCC 31

Dec Code SFCC 49

Purpose Specifies the line spacing at 7/72–inch (10.3 lpi) increments.

Discussion When the 7/72–inch line spacing control code is received, all lines will be printed at the 7/72–inch line spacing until a new line spacing is selected or power is reset. The control code line spacing selection will override the operator panel line spacing setting, and the message display will reflect the line spacing as 10.3 lines per inch.

Caution should be used when combining this control code with other print attributes such as Elongated (Double High), Superscript, or Subscript; overlapping lines may occur. Printing at different horizontal and vertical densities will not overlap.

Example The following example illustrates 7/72–inch line spacing.

```
10 LPRINT "Control code ESC 1 sets"
20 LPRINT CHR$(27);"1";
30 LPRINT "line spacing at"
40 LPRINT "7/72 inch for all subsequent lines"
50 LPRINT "until reset or another spacing is selected."
```

```
Control code ESC 1 sets
line spacing at
7/72 inch for all subsequent lines
until reset or another spacing is selected.
```

Line Spacing *n*/72 Inch

ASCII Code SFCC A *n*

Hex Code SFCC 41 *n*

Dec Code SFCC 65 *n*

Purpose Stores a line spacing of *n*/72–inch increments.

where *n* = 1 to 85 (all others are ignored)

Discussion When the SFCC A control sequence is received, all line feed commands following an SFCC 2 sequence* will be at *n*/72–inch line spacing until a new line spacing is selected or power is reset. The control code line spacing selection will override the operator panel line spacing setting.

*The SFCC 2 sequence (page 4–35) asserts the line spacing which was stored by the preceding SFCC A sequence.

Small values of *n* may result in overlapping lines. Overlapping lines may also occur if print attributes such as Elongated (Double High), Superscript, or Subscript characters are used on the same line. Printing at different horizontal and vertical densities will not overlap.

Example The following example illustrates 20/72–inch line spacing.

```
10 LPRINT "Control code ESC A 20 sets"
20 LPRINT CHR$(27);"A";CHR$(20);CHR$(27);"2";
30 LPRINT "line spacing at 20/72 inch"
40 LPRINT "increments for all subsequent lines"
50 LPRINT "until reset or another spacing is selected."
```

```
Control code ESC A 20 sets
line spacing at 20/72 inch

increments for all subsequent lines

until reset or another spacing is selected.
```

Line Spacing *n*/216 Inch

ASCII Code SFCC 3 *n*

Hex Code SFCC 33 *n*

Dec Code SFCC 51 *n*

Purpose Specifies the line spacing at *n*/216–inch increments.

where *n* = 1 to 255

Discussion When the *n*/216–inch line spacing control code is received, all line feeds following will be at *n*/216–inch line spacing until a new line spacing is selected or power is reset. The control code line spacing selection will override the operator panel line spacing setting.

The vertical character position moves only in multiples of the current dot row spacing. If the distance to move is other than a multiple of the current dot row spacing, the remainder is added to the next paper motion command.

Caution should be used when combining this control code with other print attributes such as Elongated (Double High), Superscript, or Subscript; overlapping lines may occur. Printing at different horizontal and vertical densities will not overlap.

Example The following example illustrates *n*/216–inch line spacing.

```
10 LPRINT "Control code ESC 3 50 sets"
20 LPRINT CHR$(27);"3";CHR$(50);
30 LPRINT "line spacing at 50/216 inch"
40 LPRINT "increments for all subsequent lines"
50 LPRINT "until reset or another spacing is selected."
```

```
Control code ESC 3 50 sets
line spacing at 50/216 inch
increments for all subsequent lines
until reset or another spacing is selected.
```

Overscoring

ASCII Code SFCC _ *n*

Hex Code SFCC 5F *n*

Dec Code SFCC 95 *n*

Purpose Enables or disables automatic overscoring of all characters.

where *n* = 0 to disable automatic overscoring (hex 00 or hex 30)
n = 1 to enable automatic overscoring (hex 01 or hex 31)

Discussion When automatic overscore is enabled, all characters, including spaces, will be overscored until disabled.

Example The following sample program illustrates automatic overscoring and overscoring reset.

```
10 LPRINT "Control code ESC _ 1"
20 LPRINT CHR$(27);"_";CHR$(1);
30 LPRINT "enables automatic overscoring."
40 LPRINT "Control code ESC _ 0"
50 LPRINT CHR$(27);"_";CHR$(0);
60 LPRINT "disables automatic overscoring."
```

```
Control code ESC _ 1
enables automatic overscoring.
Control code ESC _ 0
disables automatic overscoring.
```

Plot, Even Dot (P–Series High Density Graphics)

ASCII Code	EOT	SFCC d
Hex Code	04	SFCC 64
Dec Code	04	SFCC 100

Purpose Prints dots at the even numbered dot columns.

Discussion The even dot plot code is used for programming high density graphics and must be used in conjunction with the Odd Dot Plot code (05 hex). Refer to the P–Series Compatible Plot mode section in Chapter 7 (Graphics) for detailed plot mode information.

Example Print two high density plot boxes using odd and even dot plot for high density graphics. Compare the example below to the normal density odd dot plot example on page 4–43.

```
10 LPRINT "EVEN AND ODD DOT PLOT" : LPRINT
20 LPRINT CHR$(4);"??????@@@@@@??????"
30 LPRINT CHR$(5);"??????@@@@@@??????"
40 FOR I=1 TO 36
50 LPRINT CHR$(4);"A@@@@ @@@@@@A@@@@ "
60 LPRINT CHR$(5);"A@@@@ @@@@@@A@@@@ "
70 NEXT I
80 LPRINT CHR$(4);"??????@@@@@@??????"
90 LPRINT CHR$(5);"??????@@@@@@??????"
```

```
EVEN AND ODD DOT PLOT
```

Plot, Odd Dot (P–Series Normal Density Graphics)

ASCII Code	ENQ	SFCC e
Hex Code	05	SFCC 65
Dec Code	05	SFCC 101

Purpose Prints dots at the odd numbered dot columns.

Discussion This is the P–Series programming normal density graphics control code. The ENQ code should occur before any printable data in the data stream. For high density graphics, the Even Dot Plot code (04 hex) must be used in conjunction with (and precede) the Odd Dot Plot code. Refer to the P–Series Compatible Plot mode section in the Chapter 7 (Graphics) for detailed plot mode information.

Example Print two normal density plot boxes using odd dot plot. Compare the odd dot plot example below to the high density Even Dot Plot example on page 4–42.

```
10 LPRINT "ODD DOT PLOT" : LPRINT
20 LPRINT CHR$(5);"??????@@@@@@??????"
30 FOR I=1 TO 36
40 LPRINT CHR$(5);"A@@@@ @@@@@@@A@@@@ "
50 NEXT I
60 LPRINT CHR$(5);"??????@@@@@@??????"
```

```
ODD DOT PLOT
```

Print Mode/Pitch Selection

ASCII Code SFCC PMODE; *n*
SFCC X *mn*
SFCC [*n*q

Hex Code
SFCC 58 *mn*
SFCC 5B *n* 71

Dec Code
SFCC 88 *mn*
SFCC 91 *n* 113

Purpose Selects the print mode and character pitch in characters per inch (cpi).

where In SFCC PMODE; *n*
n ranges from 0 to 6 to select the print mode/pitch combinations available from Table 4–8. All other values will result in an error message.

where: In SFCC [*n*q
n = Print Mode/Pitch code (values other than those shown in Table 4–9 are ignored.)
q = Command sequence terminator

where In SFCC X *mn*
m = Print Mode code *n* = Pitch (cpi)

An asterisk (*) (hex 2A) may be substituted for *m* or *n*. Whenever the asterisk replaces ***m*** or ***n***, its current value will not change. Values other than those shown in Table 4–10 and Table 4–11 are ignored.

NOTE: The print mode must be changed before the first printable symbol of a print line or the command sequence is deferred until the next line.

Discussion P–Series PMODE switches to the Primary Character Set and selects print mode and pitch.

Print mode and pitch can also be selected from the operator panel. The print mode/pitch select control code from the host computer will override the operator panel print mode setting and the print mode and pitch selection will be reflected on the message display.

A complete set of tables identifying print mode, pitch, and dot densities for all print modes follows.

Table 4–8. Print Mode and Pitch – (SFCC PMODE;*n*)

n	Print Mode and Pitch
0	DP 10 cpi
1	DP 12 cpi
2	DP 15 cpi
3	NLQ 10 cpi
4	DP 10 cpi
5	OCR–A 10 cpi
6	OCR–B 10 cpi

Table 4–9. Print Mode and Pitch – (SFCC [*n*q)

n	Print Mode and Pitch
1(31)	NLQ 10 cpi
2(32)	DP 10 cpi
3(33)	Draft 12 cpi
4(34)	DP 12 cpi
5(35)	DP 13 cpi

Table 4–10. Horizontal and Vertical Dot Density – (SFCC X)

m (Hex*)	Horizontal Density Resolution	Vertical Density	Discussion
0(30)	120 dpi	72 dpi	DP
1(31)	180 dpi	96 dpi	NLQ
2(32)	120 dpi	48 dpi	Draft
3(33)	120 dpi	48 dpi	Draft
4(34)	120 dpi	48 dpi	Draft
5(35)	120 dpi	144 dpi	OCR–A
6(36)	120 dpi	144 dpi	OCR–B
7(37)	120 dpi	72 dpi	DP
8(38)	120 dpi	72 dpi	DP

*The hex values shown (i.e., 0 and 30) are equal. Either value can be used in your program expression.

Table 4–11. Print Mode and Character Pitches (SFCC X)

Characters per inch									
value of *n*:	**value of *m*:**								
Print Mode*	**DP 0(30)**	**NLQ 1(31)**	**DRAFT 2(32)**	**DRAFT 3(33)**	**DRAFT 4(34)**	**OCR–A 5(35)**	**OCR–B 6 (36)**	**DP 7 (37)**	**DP 8 (38)**
0(30)	10	10	10	10	10	10	10	10	10
1(31)	12	12	12	12	12	–	–	–	–
2(32)	13	13	13	13	13	–	–	–	–
3(33)	15	15	15	15	15	–	–	–	–
4(34)	17	17	17	17	17	–	–	–	–

*The hex values shown (i.e., 0 and 30) are equal. Either value can be used in your program expression. The value of *m* is is represented by the font choice line.

NOTE: When using the Multinational character set in OCR–A or OCR–B print mode, a unique character set is used. Refer to the Multinational Character Sets section for more information.

Example Any of the BASIC expressions listed below will select the DP print mode at 17 cpi.

where: *m* (print mode) = 0 or 30 for DP; and
n (pitch) = 4 or 34 for 17 cpi.

```
CHR$(1);"X";CHR$(0);CHR$(4);

CHR$(1);"X";CHR$(30);CHR$(34);

CHR$(1);"X04";
```

Superscript/Subscript Printing

ASCII Code SFCC S *n*

Hex Code SFCC 53 *n*

Dec Code SFCC 83 *n*

Purpose Selects superscript or subscript printing.

Discussion An SFCC S code can be set for superscript or subscript printing, as follows:

where *n* = 0 to enable superscript printing (hex 00 or hex 30)
n = 1 to enable subscript printing (hex 01 or hex 31)

When this control code is received, all characters will be superscript or subscript until reset by the super/subscript printing reset control code (SFCC T) or printer reset. Use caution when combining this command with other print attributes; arbitrary combinations might yield unexpected results.

NOTE: Superscript and subscript characters print at the same size as the current font. They are shifted up or down one half of a line.

Example The following sample program illustrates superscript/subscript printing.

```
10 LPRINT "Control Code ESC S 0 selects";
20 LPRINT CHR$(27);"S";CHR$(0);" SUPERSCRIPT";CHR$(27);"T"
30 LPRINT "A";CHR$(27);"S";CHR$(0);"2";CHR$(27);"T";
40 LPRINT "+B";CHR$(27);"S";CHR$(0);"2";CHR$(27);"T";
50 LPRINT "=C";CHR$(27);"S";CHR$(0);"2";
60 LPRINT CHR$(27);"T"
70 LPRINT "Control Code ESC S 1 selects";
80 LPRINT CHR$(27);"S";CHR$(1);" SUBSCRIPT";CHR$(27);"T"
90 LPRINT "31";CHR$(27);"S";CHR$(1);"HEX";CHR$(27);"T";
100 LPRINT " 49 ";CHR$(27);"S";CHR$(1);"DEC";
110 LPRINT CHR$(27);"T"
120 LPRINT "Control Code ESC T cancels"
130 LPRINT "superscript/subscript printing."
```

```
Control Code ESC S 0 selects SUPERSCRIPT
A2+B2=C2
Control Code ESC S 1 selects SUBSCRIPT
31HEX 49 DEC
Control Code ESC T cancels
superscript/subscript printing.
```

Superscript/Subscript Printing Reset

ASCII Code SFCC T

Hex Code SFCC 54

Dec Code SFCC 84

Purpose Resets superscript and subscript printing.

Underline

ASCII Code SFCC – *n*

Hex Code SFCC 2D *n*

Dec Code SFCC 45 *n*

Purpose Enables or disables automatic underlining of all characters.

where *n* = 0 to disable automatic underlining (hex 00 or hex 30)
n = 1 to enable automatic underlining (hex 01 or hex 31)

Discussion When automatic underline is enabled, all characters, including spaces, will be underlined until disabled.

Example The following sample program illustrates automatic underlining.

```
10 LPRINT "Control code ESC -1"
20 LPRINT CHR$(27);"-";CHR$(1);
30 LPRINT "enables automatic underlining."
40 LPRINT "Control code ESC -0"
50 LPRINT CHR$(27);"-";CHR$(0);
60 LPRINT "disables automatic underlining."
```

```
Control code ESC -1
enables automatic underlining.
Control code ESC -0
disables automatic underlining.
```

VFU Commands (P–Series)

ASCII Code Refer to the P–Series EVFU section in Chapter 8.

NOTE: If the SFCC being used is ESC, the PI line must be set high when using the EVFU.

Purpose Load and execute the VFU.

Discussion Refer to Chapter 8 for detailed information.

Vertical Tab

ASCII Code VT

Hex Code 0B

Dec Code 11

Purpose Prints the data in the buffer and advances the paper to the next vertical tab position.

Discussion If a vertical tab format is defined in the EVFU (channel 12) and the VFU is enabled, the paper is moved to the next vertical tab position.

If a vertical tab format is not defined, the paper is advanced to the next line at the current line spacing. More information on Vertical Tabs is provided in the EVFU section of Chapter 8.

5 Serial Matrix Printer Emulation

Chapter Contents

Overview

This chapter describes the Serial Matrix emulation host control codes that are supported for IBM 6400 ASCII printers. Emulation refers to the ability of a printer to execute the commands of a particular printer control language. A printer control language is the coding system used to convey, manipulate, and print data. Carriage Return, print quality, character attributes such as bold and underline, margins, and tabs are typical functions selected by printer control language codes. In this manual, the terms emulation, printer protocol, and printer control language are synonymous.

The Serial Matrix emulation is very similar to the code system used by an IBM Graphics Printer, but contains more features. This emulation enables a 6400 line matrix printer to print files coded for a serial matrix printer. To select the Serial Matrix emulation mode as the active printer configuration, refer to the ASCII Emulation Selection menu in Chapter 4 of the *6400 Line Matrix Printer Setup Guide* (S246–0116).

The Serial Matrix emulation provides many configurable parameters. The default parameter values for this emulation are shown in Table 5–1. You can modify the emulation parameter values in two ways:

- **The Serial Matrix host control codes.** An extensive set of Serial Matrix control code commands can be sent to the printer from an attached host computer via the host data stream. Most of this chapter is devoted to describing the Serial Matrix control codes.
- **The printer configuration menus.** You can modify a subset of the Serial Matrix emulation parameters using the operator panel keys and LCD display, as described in the *Setup Guide.*

Control codes sent from a host system generally override previous settings that result from the configuration menus. However, any configuration settings from host control codes will be gone once the printer is powered off (or reset to the default values), unless you have saved them to NVRAM using the configuration menus. The *Setup Guide* describes the Save Custom Sets option for saving changes to your printer's NVRAM.

The emulation's response to several of the control codes depends on the configuration. For example, upon receipt of the carriage return control code, the emulation will either perform a carriage return function only, or a carriage return and line feed, based on the configuration for the CR function.

Serial Matrix Default Values and States

Your printer's onboard memory stores a set of typical operating states and conditions for the P–Series emulation. When you power on the printer and select this emulation, the default settings in Table 5–1 are automatically invoked.

Table 5–1. Serial Matrix Default Settings

Characteristic	Default Setting
Character Sets	IBM PC
Print Language	
IBM PC	
Select Subset Primary	ASCII (USA)
Select Subset Extended	0437 IBM PC
Multinational	ASCII (USA)
ECMA Latin 1	
Select Subset Primary	ASCII (USA)
Select Subset Extended	Multinational
DEC Multinational	ASCII (USA)
Control Code 06	8.0 LPI
Define CR Code	CR = CR
Auto LF	Enable
Overstrike	Enable
Define LF Code	LF = LF
Printer Select	1
Alternate Set 80–9F	Control Code

Table 5–2 lists several additional default settings for parameters that are provided by the Print Format menus (described in Chapter 4 of the *Setup*

Guide). Many of the settings shown in Table 5–2 can be overridden by host control codes for the same parameter.

Table 5–2. Print Format Default Settings

Characteristic	Default Setting	
CPI	10.0	
LPI	6.0	
Forms Width	Inches Millimeters Characters	13.6 inches 345.4 mm 136 characters
Forms Length	Inches Millimeters Lines	11.0 inches 279 mm 66 lines
Print Quality	DP Quality	
Proportional Spacing	Disable	
Italic Print	Disable	
Slashed Zero	Disable	
Left Margin	0 columns	
Right Margin	0 columns	
Bottom Margin	0 lines	
Perforation Skip	Disable	

Configuring the Serial Matrix Emulation with Control Codes

The remainder of this chapter describes the Serial Matrix printer control language codes that may be sent from a host computer attached to the printer, in order to configure and invoke numerous printer functions.

Format for Control Code Descriptions

The following information is listed for each code function (where applicable and possible).

Name The title or function of the command.

ASCII Code The standard ASCII name for the control code.

Hex Code The code's numeric equivalent in hexadecimal.

Decimal Code The code's numeric equivalent in decimal.

Expression The control codes used in the BASIC programming language (where applicable).

Purpose The function(s) of the control code.

Discussion A description of exceptions or limitations to normal use.

Example A sample written in BASIC programming language is provided for some control codes when it is possible to illustrate the effect of a control code, or if a specific syntax is required to complete the program statement (i.e. Horizontal Tab set, Vertical Tab set/clear). The programs in this chapter were run on an IBM Personal Computer using Microsoft** GW-BASIC** version 3.22.

IMPORTANT

All print samples in this chapter were run on an impact printer that has a dot resolution of 1/60–inch horizontally and 1/72–inch vertically. Your printouts might look different from the samples provided in this printout, depending on the resolution of the printer in use.

WARNING: If you specify any parameters for a control code other than the ones that are defined in the control code description, unpredictable results may occur.

Special Function Control Character (SFCC)

When a printer control code consists of more than one character, it is called a command sequence. Every printer protocol uses a Special Function Control Character (SFCC) as the first character of a command sequence. The SFCC alerts the printer that a command sequence—not printable characters—follows.

The ASCII **ESC** character is always the SFCC in this emulation mode.

The general format for a command sequence is:

(ESC)(parameter 1)(parameter 2)...(parameter n)

NOTE: ESC command sequences written in BASIC must end with a semicolon (;) or with text following the command string. Without the semicolon, BASIC sends a carriage–return–line–feed (CR+LF) command to the printer.

For example, to enable bold print use the ESC character and the bold print control code character G:
ASCII: **ESC G** = Hex **1B 47** = BASIC: **CHR$(27);"G";**

Attribute Set and Reset Codes

Certain print attributes are set or reset (turned on or off) by using the appropriate ESC code sequence and the numbers 1 or 0. These may be either the hexadecimal code 01 and 00, or the ASCII code for the printable symbols of decimal 1 and 0 (hexadecimal code 31 and 30, respectively). Expanded Print, Super/Subscript Print, and Underline are attributes which are set/reset in this fashion.

NUL Code

NUL (Hex 00) is ignored by the printer and can be used as a fill character; however, it can not be used to add blank spaces since it is not a space character. NUL can also be used as a parameter terminator for the Set Horizontal Tabs (page 5–42) or Set Vertical Tabs multibyte control code (page 5–59).

NOTE: Hex ‘80‘ in PC Character Set 1 and Hex ‘7F‘ in PC Character Set 2 are treated as a NUL; however, these two controls can not be used as parameter terminators.

Print Modes Supported for Character Sets

Following is a summary of which print modes are supported for the P–Series/Serial Matrix emulation character sets. Additional information about character set support is provided under the heading "Notes." P–Series/Serial Matrix code pages for each character set in NLQ and Draft modes are provided in Appendix F.

Table 5–3. Character Set Print Mode Support

Character Set	NLQ	DP	Draft	Notes
IBM PC, Primary Subset ASCII (USA) French German English (UK) Danish Swedish Italian Spanish Japanese French Canadian Latin American Danish II Spanish II Latin American II	X	X	X	The print mode support is the same for all of the IBM PC Primary Subset languages.
IBM PC, Extended Subset 0437 IBM PC 0850 PC Multilingual	X	X	X	The print mode support is the same for both Extended character sets.
Multinational ASCII (USA)	X	X	X	
Multinational EBCDIC	X	X	X	
ECMA Latin I, Primary Subset ASCII (USA) German Swedish Danish Norwegian Finnish English (UK) Dutch French Spanish Italian Turkish Japanese	X	X	X	The print mode support is the same for all of the ECMA Latin I Primary Subset languages.

(continued next page)

Table 5–3. Character Set Print Mode Support *(continued)*

Character Set	NLQ	DP	Draft	Notes
ECMA Latin I, Extended Subset Barcode 10 CPI Multinational DP 10 CPI Multinational DP 12 CPI Multinational NLQ 10 CPI Greek DP 10 CPI Greek DP 12 CPI Greek NLQ 10 CPI Graphic DP 10 CPI Graphic NLQ 10 CPI Scientific DP 10 CPI Scientific DP 12 CPI Scientific NLQ 10 CPI	N/A	N/A	N/A	These character sets are guaranteed readable only in the Print Quality and Print Density specified.
DEC Multinational French German English (UK) Norwegian / Danish Swedish Italian Spanish Japanese French Canadian Dutch Finnish Swiss	X	X	X	The print mode support is the same for all of the DEC Multinational languages.
OCR–A / OCR–B	N/A	N/A	N/A	Only 10 cpi OCR is supported.

The Control Codes

This index lists each printer command by function, ASCII mnemonic, and the page where the command is explained in detail. "N/A" means not applicable. The rest of this chapter defines the control code functions for Serial Matrix Emulation mode. The commands are listed in alphabetical order.

FUNCTION	ASCII CODE	PAGE
Print Attributes		
Bold Print	ESC G	5–19
Bold Print Reset	ESC H	5–20
Condensed Print	SI ESC SI	5–29
Condensed Print Reset	DC2	5–30
Character Pitch 10 cpi	ESC P	5–22
Character Pitch 12 cpi	ESC M ESC :	5–22
Elongated (Double High) Print (1 line)	ESC h	5–31
Emphasized Print	ESC E	5–32
Emphasized Print Reset	ESC F	5–33
Expanded (Double Wide) Print	ESC W	5–34
Expanded (Double Wide) Print Reset	ESC W DC4	5–34
Expanded (Double Wide) Print (1 line)	SO ESC SO	5–35
Overscoring	ESC _	5–50
Print Mode/Pitch Selection	ESC X ESC [*nq*	5–51
Superscript/Subscript Printing	ESC S	5–55
Superscript/Subscript Printing Reset	ESC T	5–56
Underline	ESC –	5–57
Graphics		
Bit Image Mode, Single Density	ESC K	5–14
Bit Image Mode, Double Density	ESC L	5–16
Bit Image Mode, Double Density/Speed	ESC Y	5–17
Bit Image Mode, Quadruple Density	ESC Z	5–18

Backspace

ASCII Code BS

Hex Code 08

Dec Code 08

Purpose Moves the logical print head to the left one character space toward the first character column.

Discussion Moves the character position indicator one character space to the left at the current character pitch setting. The code is ignored if the logical print head is positioned at the first character column.

Example Print and backspace two character positions.

```
10 LPRINT "TTTTT";
20 LPRINT CHR$(8);CHR$(8);
30 LPRINT "=="
```

```
TTT==
```

Bell

ASCII Code BEL

Hex Code 07

Dec Code 07

Purpose Sounds the printer's buzzer/beeper.

Discussion The BEL function will sound the buzzer/beeper for 0.2 seconds upon receipt of this command.

Bit Image Mode, Single Density

ASCII Code ESC K *n1 n2*

Hex Code 1B 4B *n1 n2*

Dec Code 27 75 *n1 n2*

Purpose Selects Single (Normal) Density Bit Image graphics.

Expression CHR$(27);"K";CHR$(*n1*);CHR$(*n2*);"DATA"

where *n1* + 256*n2* define the number of data bytes to follow.
DATA = ASCII characters for the dot pattern bytes.

NOTE: The DATA can be expressed in a CHR$(DATA) format with the appropriate decimal values of the ASCII characters supplied, especially in cases where the dot patterns of nonprintable characters are required.

Discussion For detailed information, refer to the Bit Image section in the Chapter 7.

Example The following example produces a pattern of Single Density Bit Image graphics. The 9 data bit pattern is repeated 27 times. Compare this example to the double density and quadruple density examples.

NOTE: Depending on the host computer system, it may be necessary to include a width statement within the BASIC program.

```
10 WIDTH "lpt1:",255
20 LPRINT "Single Density Bit Image Graphics"
30 LPRINT CHR$(27);"K";CHR$(244);CHR$(0);
40 FOR N=1 TO 27
50 RESTORE
60 FOR I=1 TO 9
70 READ R
80 LPRINT CHR$(R);
90 NEXT I
100 NEXT N
110 LPRINT CHR$(255)
120 DATA 255,128,64,32,16,8,4,2,1
```

Single Density Bit Image Graphics

Bit Image Mode, Double Density

ASCII Code ESC L *n1 n2*

Hex Code 1B 4C *n1 n2*

Dec Code 27 76 *n1 n2*

Purpose Selects Double Density Bit Image graphics.

Expression CHR$(27);"L";CHR$(*n1*);CHR$(*n2*);"DATA"

where *n1* + 256*n2* define the number of data bytes to follow.
DATA = ASCII characters for the dot pattern bytes.

NOTE: The DATA can be expressed in a CHR$(DATA) format with the appropriate decimal values of the ASCII characters supplied especially in cases where the dot patterns of nonprintable characters are required.

Discussion Double Density printing may reduce print speed. For detailed information, refer to the Bit Image section in the chapter 7.

Example The following example produces Double Density Bit Image graphics of the pattern used in the Single Density Bit Image Mode example. Note that the amount of data must be doubled for double density (the data is used 54 times rather than 27).

NOTE: Depending on the host computer system, it may be necessary to include a width statement within the BASIC program.

```
10 WIDTH "lpt1:",255
20 LPRINT "Double Density Bit Image Graphics"
30 LPRINT CHR$(27);"L";CHR$(231);CHR$(1);
40 FOR N=1 TO 54
50 RESTORE
60 FOR I=1 TO 9
70 READ R
80 LPRINT CHR$(R);
90 NEXT I
100 NEXT N
110 LPRINT CHR$(255)
120 DATA 255,128,64,32,16,8,4,2,1
```

```
Double Density Bit Image Graphics
NNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNN
```

Bit Image Mode, Double Density Double Speed

ASCII Code ESC Y *n1 n2*

Hex Code 1B 59 *n1 n2*

Dec Code 27 89 *n1 n2*

Purpose Prints graphics faster than Double Density (same speed as Single Density) by ignoring adjacent dots.

Expression CHR$(27);″Y″;CHR$(*n1*);CHR$(*n2*);″DATA″

where *n1* + 256*n2* define the number of data bytes to follow.
DATA = ASCII characters for the dot pattern bytes.

NOTE: The DATA can be expressed in a CHR$(DATA) format with the appropriate decimal values of the ASCII characters supplied especially in cases where the dot patterns of nonprintable characters are required.

Discussion For detailed information, refer to the Bit Image section in chapter 7.

Example The following example produces Double Density Double Speed Bit Image graphics of the pattern used in the Single Density Bit Image Mode example. Note that the amount of data must be doubled for double density (the data is used 54 times rather than 27).

NOTE: Depending on the host computer system, it may be necessary to include a width statement within the BASIC program.

```
10 WIDTH "lpt1:",255
20 LPRINT "Double Density Double Speed Bit Image Graphics"
30 LPRINT CHR$(27);"Y";CHR$(231);CHR$(1);
40 FOR N=1 TO 54
50 RESTORE
60 FOR I=1 TO 9
70 READ R
80 LPRINT CHR$(R);
90 NEXT I
100 NEXT N
110 LPRINT CHR$(255)
120 DATA 255,128,64,32,16,8,4,2,1
```

```
Double Density Double Speed Bit Image Graphics
```

Bit Image Mode, Quadruple Density

ASCII Code ESC Z *n1 n2*

Hex Code 1B 5A *n1 n2*

Dec Code 27 90 *n1 n2*

Purpose Selects Quadruple Density Bit Image graphics.

Expression CHR$(27);"Z";CHR$(*n1*);CHR$(*n2*);"DATA"

where *n1* + 256*n2* define the number of data bytes to follow.
DATA = ASCII characters for the dot pattern bytes.

NOTE: The DATA can be expressed in a CHR$(DATA) format with the appropriate decimal values of the ASCII characters supplied especially in cases where the dot patterns of nonprintable characters are required.

Discussion Quadruple Density printing may reduce print speed. For detailed information, refer to the Bit Image section in chapter 7. The printed density in this mode is 240 dpi horizontal and 72 dpi vertical if selected when the DP (Data Processing) font is active.

Example The following example produces quadruple density graphics of the pattern used in the Single Density Bit Image Mode example. Note that the amount of data must be quadrupled for quadruple density (the data is used 108 times rather than 27).

NOTE: Depending on the host computer system, it may be necessary to include a width statement within the BASIC program.

```
10 WIDTH "lpt1:",255
20 LPRINT "Quad Density Bit Image Graphics"
30 LPRINT CHR$(27);"Z";CHR$(205);CHR$(3);
40 FOR N=1 TO 108
50 RESTORE
60 FOR I=1 TO 9
70 READ R
80 LPRINT CHR$(R);
90 NEXT I
100 NEXT N
110 LPRINT CHR$(255)
120 DATA 255,128,64,32,16,8,4,2,1
```

```
Quad Density Bit Image Graphics
```

Bold Print Set

ASCII Code ESC G

Hex Code 1B 47

Dec Code 27 71

Purpose Selects bold character printing.

Discussion When the bold character printing control code is received, all characters are printed in bold until reset by the bold print reset control code or printer reset. Bold Print is the same as printing double strike.

Example The following sample program illustrates bold character printing.

```
10 LPRINT "Control code ESC G"
20 LPRINT CHR$(27);"G";
30 LPRINT "selects bold character printing,"
40 LPRINT "for example: AaBbCcDdEeFfGgHhIiJjKkLlMmNnOoPp."
50 LPRINT "Control code ESC H"
60 LPRINT CHR$(27);"H";
70 LPRINT "cancels bold character printing."
```

```
Control code ESC G
selects bold character printing,
for example: AaBbCcDdEeFfGgHhIiJjKkLlMmNnOoPp.
Control code ESC H
cancels bold character printing.
```

Bold Print Reset

ASCII Code ESC H

Hex Code 1B 48

Dec Code 27 72

Purpose Resets bold character printing.

Discussion The bold print reset control code only resets the bold print character attribute. Other print attributes such as double wide printing are not affected.

Example Refer to the Bold Print control code for a sample program of bold character print set and reset.

Cancel

ASCII Code CAN

Hex Code 18

Dec Code 24

Purpose Clears the print buffer of all printable symbols since the last paper motion command was received.

Discussion This control code may be used as a delete line function but should be used with extreme care to avoid possible misprinting. This control code will cancel the double wide attribute set by SO if active. No other print attributes are affected.

Carriage Return

ASCII Code CR

Hex Code 0D

Dec Code 13

Purpose Returns the logical print head to the first character column (resets the pointer to the first character position).

Discussion The CR code may or may not cause printing or paper motion, depending on the DEFINE CR CODE configuration parameter value. If the DEFINE CR CODE submenu displays the following, the characters following the CR are printed over the previous characters on the line:

```
DEFINE CR CODE
CR=CR
```

If identical characters are placed in the same position on the line, those characters will be printed in bold (double strike) print when the Overstrike Mode is enabled from the operator panel.

The CR=CR configuration causes subsequent printable data to overprint previous data at half speed if Overstrike is enabled from the operator panel (and prints somewhat faster if Overstrike is disabled), unless an intervening paper motion command is received. If the DEFINE CR CODE submenu displays the following, the control code CR is converted to perform a carriage return and line feed function:

```
DEFINE CR CODE
CR=CR+LF
```

The CR code in Serial Matrix printer protocol cancels expanded (double wide) print when set by code SO and ESC SO (single line printing attribute).

Character Pitch 10 CPI

ASCII Code ESC P

Hex Code 1B 50

Dec Code 27 80

Purpose Sets character pitch to 10 cpi.

Discussion Control Code ESC X can also be used to select a character pitch of 10 cpi. Refer to Print Mode/Pitch Selection on page 5–51.

Character Pitch 12 CPI

ASCII Code ESC M
ESC :

Hex Code 1B 4D
1B 3A

Dec Code 27 77
27 58

Purpose Sets character pitch to 12 cpi.

Discussion Control Code ESC X can also be used to select a character pitch of 12 cpi. Refer to Print Mode/Pitch Selection on page 5–51.

Character Set Select

ASCII Code ESC 1 *xyz*
(lowercase L)

Hex Code 1B 6C *xyz*

Dec Code 27 108 *xyz*

Purpose Selects the character set, extended character set, and the international language for a specific character set. Refer to Appendix F for individual character set charts.

Expression CHR$(27);"l";CHR$(x);CHR$(y);CHR$(z);

where ***x*** is the character set (Table 5–4);

y is the international language for the selected character set (Table 5–5);

z is the extended character set for the selected character set (Table 5–6);

Table 5–4. Character Set Select (*x*)

x	Character Set
0(30)	IBM PC
1(31)	Multinational
2(32)	ECMA 94 Latin 1
3(33)	DEC Multinational

Table 5–5. International Language Select (*y*)

y	*x* 0(30) IBM PC	1(31) Multinational	2(32) ECMA 94 Latin 1	3(33) DEC Multinational
0(30)	ASCII (USA)	ASCII (USA)	ASCII (USA)	ASCII (USA)
1(31)	French	EBCDIC	German	French
2(32)	German		Swedish	German
3(33)	English		Danish	English
4(34)	Danish		Norwegian	Norwegian/Danish
5(35)	Swedish		Finnish	Swedish
6(36)	Italian		English	Italian
7(37)	Spanish		Dutch	Spanish
8(38)	Japanese		French	Japanese
9(39)	French Canadian		Spanish	French Canadian
10(3A)	Latin American		Italian	Dutch
11(3B)	Danish–II		Turkish	Finnish
12(3C)	Spanish–II		Japanese	Swiss
13(3D)	Latin American–II			

Table 5–6. Extended Character Set Select (*z*)

z	x 0(30) IBM PC	1(31) Multinational	2(32) ECMA 94 Latin I	3(33) DEC Multinational
0(30)	IBM PC (0437)	Multinational Extended Set	Barcode 10 cpi	DEC Multinational Extended Set
1(31)	IBM PC (0850)		Multinational DP 10 cpi	
2(32)			Multinational DP 12 cpi	
3(33)			Multinational NLQ 10 cpi	
4(34)			Greek DP 10 cpi	
5(35)			Greek DP 12 cpi	
6(36)			Greek NLQ 10 cpi	
7(37)			Graphics DP 10 cpi	
8(38)			Graphics NLQ 10 cpi	
9(39)			Scientific DP 10 cpi	
10(3A)			Scientific DP 12 cpi	
11(3B)			Scientific NLQ 10 cpi	
12(3C)			Multinational (at Primary set mode and pitch)	

Discussion If the asterisk (*) is the value selected for *x*, the character set will not change. If * is the value selected for *y* or *z*, the previously selected international language and/or extended character set for the selected character set will be used.

The character set, international language and extended character set can also be selected from the operator panel. The control code setting will override the operator panel selection. Values other than those shown in the tables will result in the control sequence being terminated.

Appendix F provides print samples for each character set, shown in NLQ and Draft print modes. A table on page 5–8 provides detailed notes on print mode support for each character set.

Characters 80–9F (Control Codes)

ASCII Code ESC 7

Hex Code 1B 37

Dec Code 27 55

Purpose Selects the character set wherein hex codes 80 to 9F are control codes. Also includes hex codes 03 to 06 and 15 in the Serial Matrix printer protocol. Cancels Character Set Select activated by ESC 6 or ESC u.

Discussion This feature can also be selected from the operator panel (Alternate Set 80–9F Serial Matrix menu option).

Characters 80–9F (Printable Symbols)

ASCII Code ESC 6

Hex Code 1B 36

Dec Code 27 54

Purpose Selects the character set wherein hex codes 80 to 9F are printable symbols. Also includes hex codes 03 to 06 and 15 in the Serial Matrix printer protocol. Cancels Character Set Select activated by ESC 7 or ESC u.

Discussion Hex codes 80–9F can also be configured as printable from the operator panel (Alternate Set 80–9F Serial Matrix menu option).

Characters 80–9F (Printable Symbols)

ASCII Code ESC u

Hex Code 1B 75

Dec Code 27 117

Purpose Selects the character set wherein hex codes 80 to 9F are printable symbols. Hex codes 03 to 06 and 15 are treated like control codes. Cancels Character Set Select activated by ESC 6 or ESC 7.

Discussion Hex codes 80–9F can also be configured as printable from the operator panel (Alternate Set 80–9F Serial Matrix menu option).

Character Set Select: International Languages

ASCII Code ESC R*n*

Hex Code 1B 52 *n*

Dec Code 27 82 *n*

Purpose Specifies the international language set identified by *n* in the basic character set selected from the operator panel (ECMA 94 Latin 1, IBM PC, Multinational, and DEC Multinational). Refer to Appendix F for individual character set charts.

where *n* corresponds to the language as shown in Table 5–7 below.

Table 5–7. International Character Sets

"n"	Character Set Selected			
ESC R (hex)	**ECMA 94 Latin 1**	**IBM PC (0437 or 0850)**	**Multinational**	**DEC Multinational**
0(30)	ASCII (USA)	ASCII (USA)	ASCII (USA)	ASCII (USA)
1(31)	German	French	EBCDIC	French
2(32)	Swedish	German		German
3(33)	Danish	English		English
4(34)	Norwegian	Danish		Norwegian/Danish
5(35)	Finnish	Swedish		Swedish
6(36)	English	Italian		Italian
7(37)	Dutch	Spanish		Spanish
8(38)	French	Japanese		Japanese
9(39)	Spanish	French Canadian		French Canadian
0A(3A)	Italian	Latin American		Dutch
0B(3B)	Turkish	Danish–II		Finnish
0C(3C)	Japanese	Spanish–II		Swiss
0D(3D)		Latin American–II		
0E(3E)				
0F(3F)				
10(40)				
11(41)		*(currently undefined)*		
12(42)				
13(43)				
14(44)				
15(45)				

Character Set Select: International Languages (continued)

Discussion The international character set can also be selected from the operator panel. The control code setting will override the operator panel character set selection. Values other than those selectable from Table 5–7 will be ignored.

Example The following example illustrates international character selection using the IBM PC character set.

```
10 LPRINT "Control code ESC R 5 selects"
20 LPRINT "the Swedish character set shown beneath"
30 LPRINT "the USA (ASCII) characters."
40 LPRINT
50 LPRINT "A B C D [ \ ] ^ _ ` { | } ~"
60 LPRINT CHR$(27);"R";CHR$(5);
70 LPRINT "A B C D [ \ ] ^ _ ` { | } ~"
80 LPRINT CHR$(27);"R";CHR$(0);
```

```
10 LPRINT "Control code ESC R 5 selects"
20 LPRINT "the Swedish character set shown beneath"
30 LPRINT "the USA (ASCII) characters."
40 LPRINT
50 LPRINT "A B C D [ \ ] ^ _ ` { | } ~"
60 LPRINT CHR$(27);"R";CHR$(5);
70 LPRINT "A B C D [ \ ] ^ _ ` { | } ~"
80 LPRINT CHR$(27);"R";CHR$(0);
```

```
Control code ESC R 5 selects
the Swedish character set shown beneath
the USA (ASCII) characters.

A B C D [ \ ] ^ _ ` { | } ~
A B C D Ä ö Å Ü _ é ä ö å ü
```

Condensed Print

ASCII Code SI
ESC SI

Hex Code 0F
1B 0F

Dec Code 27 15

Purpose Selects 17 characters per inch (cpi) condensed print format.

Discussion Condensed print can be selected using control code ESC X. Refer to Print Mode/Pitch Selection on page 5–51.

The Serial Matrix condensed print control code SI affects all subsequent characters. After receiving code SI, all characters will be printed in condensed print until reset by ESC M, ESC P, the condensed print reset control code DC2, printer reset, or a new print mode control code. The Serial Matrix SI code (hex 0F) is equivalent to the ESC SI code. If condensed print is not allowed in the current print mode, the code is ignored.

Example The following sample program illustrates condensed character printing and reset.

```
10 LPRINT "Control code"
20 LPRINT "SI selects"
30 LPRINT CHR$(15);
40 LPRINT "condensed character printing."
50 LPRINT "Control code DC2"
60 LPRINT CHR$(18);
70 LPRINT "resets condensed character printing."
```

```
Control code
SI selects
condensed character printing.
Control code DC2
resets condensed character printing.
```

Condensed Print Reset

ASCII Code DC2

Hex Code 12

Dec Code 18

Purpose Resets condensed character printing to 10 cpi.

Discussion The condensed print reset control code selects 10 cpi character pitch. Other print attributes are not affected.

Other control code sequences which will cancel condensed print are ESC M, ESC P, ESC @, or a new print mode control code.

Example See the Condensed Print control code subsection for an example of Condensed Print Reset.

Delete

ASCII Code DEL

Hex Code 7F

Dec Code 127

Purpose Deletes the previously received character on a line.

Discussion Characters that have been truncated due to line length restrictions are not affected by this code.

Elongated (Double High) Print (One Line Only)

ASCII Code ESC h

Hex Code 1B 68

Dec Code 27 104

Purpose Selects elongated (double high) character printing for one line only. Elongated characters are approximately double height but standard width.

Discussion The elongated character control code is a line–by–line print attribute; when the control code is received, all printable characters after the code will be printed double high and then automatically reset.

When using this feature with relative line slewing, the paper position will be moved *n*+1 lines rather than n lines. Refer to Chapter 8 for more information on relative line slewing. When using small line spacing and the lines overlap, an unexpected print format may result.

Example The following sample program illustrates elongated character printing.

```
10 LPRINT "Control code"
20 LPRINT "ESC h selects"
30 LPRINT CHR$(27);"h";
40 LPRINT "elongated character printing"
50 LPRINT "for one line only."
```

```
Control code
ESC h selects
elongated character printing
for one line only.
```

Emphasized Print

ASCII Code ESC E

Hex Code 1B 45

Dec Code 27 69

Purpose Selects emphasized character print format.

Discussion When the emphasized print control code is received, all characters will be printed in emphasized print until reset by the emphasized print reset control code or printer reset. The emphasized print attribute is implemented by horizontal shadow printing.

Emphasized print is ignored during superscript or subscript printing, and when 15–20 cpi characters have been selected.

Example The following sample program illustrates emphasized character printing.

```
10 LPRINT "Control code"
20 LPRINT "ESC E selects"
30 LPRINT CHR$(27);"E";
40 LPRINT "emphasized character printing."
42 LPRINT "Control code ESC F"
50 LPRINT CHR$(27);"F";
60 LPRINT "cancels emphasized character printing."
```

```
Control code
ESC E selects
emphasized character printing.
Control code ESC F
cancels emphasized character printing.
```

Emphasized Print Reset

ASCII Code ESC F

Hex Code 1B 46

Dec Code 27 70

Purpose Resets emphasized character printing.

Discussion The emphasized print reset control code only resets the emphasized print character attribute.

Example See the Emphasized Print control code subsection for an example of Emphasized Print Reset.

Emulation Reset

ASCII Code ESC @

Hex Code 1B 40

Dec Code 27 64

Purpose Initializes all print mode related parameters to values previously saved.

Discussion Print mode, line spacing, international language selection, margins, form length, skip–over perforation, and character pitch are reset to previously saved values. Character–by–character and line–by–line attributes are canceled. The vertical format unit is cleared. The current line is set to the top-of–form position. Interface parameters and printer protocol selection are not affected.

This command will reset the horizontal tabs to every eighth character column.

Expanded (Double Wide) Print

ASCII Code ESC W *n*

Hex Code 1B 57 *n*

Dec Code 27 87 *n*

Purpose Selects or resets expanded (double wide) print.

where *n* = 1 selects expanded print (hex 01 or hex 31)
n = 0 resets expanded print (hex 00 or hex 30)

Discussion When expanded print using ESC W is received, all characters will be printed double wide until reset by the Expanded Print Reset control code, Emulation Reset, or DC4.

Also refer to control code SO and ESC SO, Expanded (Double Wide) Print for one line only.

Example The following sample program illustrates expanded character printing and expanded character printing reset.

```
10 LPRINT "Control code"
20 LPRINT "ESC W 1 selects"
30 LPRINT CHR$(27);"W";CHR$(1);
40 LPRINT "expanded character printing."
50 LPRINT "Control code"
60 LPRINT "ESC W 0 resets"
70 LPRINT CHR$(27);"W";CHR$(0);
80 LPRINT "expanded character printing."
```

```
Control code
ESC W 1 selects
expanded character printing.
Control code
ESC W 0 resets
expanded character printing.
```

Expanded (Double Wide) Print (One Line Only)

ASCII Code SO
ESC SO

Hex Code 0E
1B 0E

Dec Code 27 14

Purpose Selects expanded (double wide) print for one line only.

Discussion This expanded print control code is a line–by–line print attribute; when the SO or ESC SO control code is received, all printable characters after the will be printed double wide and then automatically reset.

This control code can be reset by a paper motion control code (LF, VT, CR, etc.), by the DC4 (double wide cancel) code, ESC @ (Emulation Reset), CAN or ESC W (double wide print). When set by SO, double wide print is not cancelled by the Autowrap feature.

Example The following sample program illustrates Expanded Print for one line only. Another example of expanded printing is shown for Expanded (Double Wide) Print, ESC W on page 5–34.

```
10 LPRINT "Control code"
20 LPRINT "SO selects"
30 LPRINT CHR$(14);
40 LPRINT "expanded character printing"
50 LPRINT "for one line only."
```

```
Control code
SO selects
expanded character printing
for one line only.
```

Extended Character Set

ASCII Code ESC 4

Hex Code 1B 34

Dec Code 27 52

Purpose Accesses the extended character set in the range A0 to FF hex using codes 20 to 7F hex.

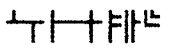
Discussion This code is used in 7–bit systems as if data bit 8 was set to 1. For example, sending code 20 hex accesses the symbol at code point A0 hex. If a printable symbol is not available at the code point, a space is printed.

ESC 4 is not cancelled by the next paper motion command.

Example The following sample program illustrates Extended Character Set.

```
10 LPRINT "Control code"
20 LPRINT "ESC 4 selects the extended character set"
30 LPRINT "and ESC 5 selects the primary character set"
40 LPRINT "which is displayed beneath the extended character set."
50 LPRINT
60 LPRINT CHR$(27);"4";
70 LPRINT "ABCDEFGH"
80 LPRINT CHR$(27);"5"
90 LPRINT "ABCDEFGH"
```

```
Control code
ESC 4 selects the extended character set
and ESC 5 selects the primary character set
which is displayed beneath the extended character set.
```



```
ABCDEFGH
```

Extended Character Set Cancel (Primary Character Set Select)

ASCII Code ESC 5

Hex Code 1B 35

Dec Code 27 53

Purpose Cancels Extended Character Set as selected by ESC 4, and selects the Primary Character Set.

Discussion This code is used in 7–bit systems as if data bit 8 was set to 0, and data is printed as characters from 20 to 7F hex.

Example Refer to the Extended Character Set example on the previous page.

Form Feed

ASCII Code FF

Hex Code 0C

Dec Code 12

Purpose Prints the data in the buffer, advances the paper position to the next top–of–form, and moves the character position to the first character column.

Discussion The default forms length is determined by the configuration in nonvolatile memory. Forms length is set by using the operator panel or forms length control codes. Code FF cancels all single–line only print attributes.

The Form Feed command will react differently when the VFU is active (refer to Chapter 8).

Forms Length Set (Inches)

ASCII Code ESC C NUL *n*

Hex Code 1B 43 0 *n*

Dec Code 27 67 0 *n*

Purpose Sets the length of forms (paper) in inches.

where *n* = whole numbers (hex values) from 1 to 24 to specify the number of inches on a page.

Discussion Upon receipt of this code, the current line becomes the first line of the form, and the form length set becomes the current forms length. Vertical tab positions set below the bottom of the form are ignored. Forms length is defined in inches; therefore, subsequent line spacing changes do not affect the result of this command.

The maximum forms length is 24 inches. All other values are ignored.

When forms length is set by the ESC C sequence, the skip–over perforation is set to zero.

Forms length can also be set through the operator panel. The control code forms length setting from the host computer will override the operator panel setting.

Forms Length Set (Lines)

ASCII Code ESC C*n*

Hex Code 1B 43 *n*

Dec Code 27 67 *n*

Purpose Sets the length of a form (paper) in lines.

where *n* = 1 to 92 (hex values) to specify the number of lines per page at the current line spacing.

Discussion The forms length set becomes the current forms length. The forms length units are always defined in inches; therefore, subsequent line spacing changes do not affect the result of this command. Changing lpi does not change the forms length.

The forms length is set to the number of lines defined by the quotient of n and the current line spacing so that the units are in inches.

If the calculated forms length in lines is not an exact multiple of the target machine dot size, the forms length value will be adjusted down to the next possible multiple.

When forms length is set by the ESC C sequence, the skip–over perforation is set to zero.

Forms length can also be set through the operator panel. The control code forms length setting from the host computer will override the operator panel setting.

Form Margins, Set

ASCII Code ESC v *n1 n2 n3 n4*

Hex Code 1B 76 *n1 n2 n3 n4*

Dec Code 27 118

Purpose Selects left (*n1*), right (*n2*), top (*n3*), and bottom (*n4*) form margins.

where *n1* = The width of the left margin (hex value) in character columns at the current cpi. If the requested margin is larger than the current (form width–right margin), the value is ignored.

n2 = The width of the right margin (hex value) in character columns at the current cpi. If the requested margin is larger than the current (form width–left margin), the value is ignored.

n3 = The length of the top margin (hex value) in character lines at the current lpi. If the requested margin is larger than the current (form length–bottom margin), the value is ignored.

n4 = The length of the bottom margin (hex value) in character lines at the current lpi. If the requested margin is larger than the current (form length–top margin), the value is ignored.

Discussion A hex value of FF for *n1*, *n2*, *n3*, or *n4* indicates that the margin remains unaffected.

When set, the right and bottom margins take effect immediately; the left margin takes effect for the current line only if no horizontal motion has occurred for the line, otherwise it takes effect on the next line. The top margin always takes effect on the next form.

Vertical tabs defined within the top and bottom margins are ignored. Horizontal tabs are offset by the left margin and ignored within the right margin.

Horizontal Tab

ASCII Code HT

Hex Code 09

Dec Code 09

Purpose Moves the logical printhead right to the next horizontal tab stop.

Discussion Power–on default horizontal tabs are set at every eighth character in the Serial Matrix printer protocol. If there are no horizontal tabs set or the logical printhead is located at the last character column, the code is ignored and no movement occurs.

Horizontal tabs are stored as a relative position; therefore, character pitch changes will change horizontal tab positions. See "Horizontal Tab Set," page 5–42, to set new tab positions.

Horizontal Tab Set

ASCII Code ESC D *n1* .... *nk* 0

Hex Code 1B 44 *n1* .... *nk* 00

Dec Code 27 68 *n1* .... *nk* 0

Purpose Sets up to 32 horizontal tab positions.

Expression CHR$(27);"D";CHR$(*n1*);...CHR$(*n32*);CHR$(0);
n = 1–255 ; *k* = 1–32

where *n1* through *n32* specify the character column of the tab positions. CHR$(0) is the sequence terminator. ESC D 0 clears all tabs.

Discussion Up to 32 different tab positions may be set. The values must be listed in ascending order or they are ignored. The physical tab position is the product of *n* and the current cell width (1/pitch), excluding double wide. Tabs in excess of 32 or those positioned beyond the paper's right margin are also ignored.

Tab positions may be cleared by sending the CHR$(27);"D";CHR$(0) sequence. Powering the printer on/off will initialize the tabs to every eighth character column. Horizontal tabs are accessed by control code HT.

Example The following example illustrates horizontal tab setting and accessing.

```
10 LPRINT "Control code"
20 LPRINT "ESC D CHR$(4);CHR$(10);CHR$(0)"
30 LPRINT "sets tab stops at columns 4 and 10."
40 LPRINT "Control code HT"
50 LPRINT "accesses the tab stops as follows:"
60 LPRINT CHR$(27);"D";CHR$(4);CHR$(10);CHR$(0);
70 LPRINT CHR$(9);
80 LPRINT "column 4"
90 LPRINT CHR$(9);CHR$(9);
100 LPRINT "column 10"
```

```
Control code
ESC D CHR$(4);CHR$(10);CHR$(0)
sets tab stops at columns 4 and 10.
Control code HT
accesses the tab stops as follows:
    column 4
          column 10
```

Line Feed

ASCII Code LF

Hex Code 0A

Dec Code 10

Purpose Prints the data in the buffer (if any) and advances the vertical character position one line at the current line space setting.

Discussion If configured for LF equals newline (LF=CR+LF), the logical print head is positioned at character column 1 of the new line. Otherwise, the logical print head does not move when configured for LF function only (LF=LF ONLY). The LF function cancels all single line print attributes such as double high (elongated) and double wide (expanded) characters.

Line Feed *n*/216 Inch (One Line Only)

ASCII Code ESC J *n*

Hex Code 1B 4A *n*

Dec Code 27 74

Purpose Advances the vertical character position n/216 inch for one line only.

where *n* = 1 to 255

Discussion The *n*/216–inch line feed control code is effective for one line only. All single–line–only print attributes are canceled.

If the protocol is configured for LF equals newline (LF=CR+LF), the paper advances one line at the current line space setting and the logical print head is positioned at character column 1.

The paper position moves only in multiples of the current dot row spacing. If the distance to move is other than a multiple of the current dot row spacing, the remainder is added to the next paper motion command.

Small values of *n* may result in overlapping lines. Overlapping lines may also occur if print attributes such as Elongated (Double High), Superscript, or Subscript characters are used on the same line. Printing at different horizontal and vertical densities will not overlap.

Example The following example illustrates *n*/216–inch line spacing.

```
10 LPRINT "Control code ESC J 200
20 LPRINT CHR$(27);"J";CHR$(200);
30 LPRINT "performs a 200/216 inch"
40 LPRINT "line feed function for one line only."
```

```
Control code ESC J 200
```

```
performs a 200/216 inch
line feed function for one line only.
```

Line Spacing 1/6 Inch

ASCII Code	ESC 2	ESC A *n*
Hex Code	1B 32	1B 41
Hex Code	27 50	27 65

Purpose ESC 2 sets line spacing to 6 lpi, or as set by ESC A.

Discussion The value of *n* should be 12 if using ESC A *n*.

ESC 2 asserts *n*/72–inch line spacing as set by ESC A (page 5–48). If no distance has been set by ESC A, the distance is 1/6 inch.

The control code line spacing selection will override the operator panel line spacing setting.

Example The following example illustrates 1/6–inch line spacing and assumes that a distance has not been set by ESC A.

```
10 LPRINT "Control code ESC 2 sets"
20 LPRINT CHR$(27);"2";
30 LPRINT "line spacing at"
40 LPRINT "6 lpi for all subsequent lines"
50 LPRINT "until reset or another spacing is selected."
```

```
Control code ESC 2 sets
line spacing at
6 lpi for all subsequent lines
until reset or another spacing is selected.
```

Line Spacing 1/8 Inch (8 lpi)

ASCII Code	ESC 0	ESC A *n*
Hex Code	1B 30	1B 41
Dec Code	27 48	27 65

Purpose Specifies continuous line spacing at 1/8–inch increments (8 lpi).

Discussion When the 1/8–inch line spacing control code, ESC 0, is received, all lines will be printed at 8 lpi until a new line spacing is selected or power is reset. The control code line spacing selection will override the operator panel line spacing setting.

The value of n should be 9 if using ESC A *n*.

Example The following example illustrates 1/8–inch line spacing.

```
10 LPRINT "Control code ESC 0 sets"
20 LPRINT CHR$(27);"0";
30 LPRINT "line spacing at"
40 LPRINT "1/8 (8 lpi) inch for all subsequent lines"
50 LPRINT "until reset or another spacing is selected."
```

```
Control code ESC 0 sets
line spacing at
1/8 (8 lpi) inch for all subsequent lines
until reset or another spacing is selected.
```

Line Spacing 7/72 Inch

ASCII Code ESC 1

Hex Code 1B 31

Dec Code 27 49

Purpose Specifies the line spacing at 7/72–inch (10.3 lpi) increments.

Discussion When the 7/72–inch line spacing control code is received, all lines will be printed at the 7/72–inch line spacing until a new line spacing is selected or power is reset. The control code line spacing selection will override the operator panel line spacing setting, and the message display will reflect the line spacing as 10.3 lines per inch.

Caution should be used when combining this control code with other print attributes such as Elongated (Double High), Superscript, or Subscript; overlapping lines may occur. Printing at different horizontal and vertical densities will not overlap.

Example The following example illustrates 7/72–inch line spacing.

```
10 LPRINT "Control code ESC 1 sets"
20 LPRINT CHR$(27);"1";
30 LPRINT "line spacing at"
40 LPRINT "7/72 inch for all subsequent lines"
50 LPRINT "until reset or another spacing is selected."
```

```
Control code ESC 1 sets
line spacing at
7/72 inch for all subsequent lines
until reset or another spacing is selected.
```

Line Spacing *n*/72 Inch

ASCII Code ESC A *n*

Hex Code 1B 41 *n*

Dec Code 27 65 *n*

Purpose Stores a line spacing of *n*/72–inch increments.

where *n* = 1 to 85 (all others are ignored)

Discussion When the ESC A control sequence is received, all line feed commands following an ESC 2 sequence* will be at *n*/72–inch line spacing until a new line spacing is selected or power is reset. The control code line spacing selection will override the operator panel line spacing setting.

*The ESC 2 sequence (page 5–45) asserts the line spacing which was stored by the preceding ESC A sequence.

Small values of n may result in overlapping lines. Overlapping lines may also occur if print attributes such as Elongated (Double High), Superscript, or Subscript characters are used on the same line. Printing at different horizontal and vertical densities will not overlap.

Example The following example illustrates 20/72–inch line spacing.

```
10 LPRINT "Control code ESC A 20 sets"
20 LPRINT CHR$(27);"A";CHR$(20);CHR$(27);"2";
30 LPRINT "line spacing at 20/72 inch"
40 LPRINT "increments for all subsequent lines"
50 LPRINT "until reset or another spacing is selected."
```

```
Control code ESC A 20 sets
line spacing at 20/72 inch

increments for all subsequent lines

until reset or another spacing is selected.
```

Line Spacing *n*/216 Inch

ASCII Code ESC 3 *n*

Hex Code 1B 33 *n*

Dec Code 27 51 *n*

Purpose Specifies the line spacing at *n*/216–inch increments.

where *n* = 1 to 255

Discussion When the *n*/216–inch line spacing control code is received, all line feeds following will be at *n*/216–inch line spacing until a new line spacing is selected or power is reset. The control code line spacing selection will override the operator panel line spacing setting.

The vertical character position moves only in multiples of the current dot row spacing. If the distance to move is other than a multiple of the current dot row spacing, the remainder is added to the next paper motion command.

Caution should be used when combining this control code with other print attributes such as Elongated (Double High), Superscript, or Subscript; overlapping lines may occur. Printing at different horizontal and vertical densities will not overlap.

Example The following example illustrates *n*/216–inch line spacing.

```
10 LPRINT "Control code ESC 3 50 sets"
20 LPRINT CHR$(27);"3";CHR$(50);
30 LPRINT "line spacing at 50/216 inch"
40 LPRINT "increments for all subsequent lines"
50 LPRINT "until reset or another spacing is selected."
```

```
Control code ESC 3 50 sets
line spacing at 50/216 inch
increments for all subsequent lines
until reset or another spacing is selected.
```

Overscoring

ASCII Code ESC _ *n*

Hex Code 1B 5F *n*

Dec Code 27 95 *n*

Purpose Enables or disables automatic overscoring of all characters.

where *n* = 0 to disable automatic overscoring (hex 00 or hex 30)
n = 1 to enable automatic overscoring (hex 01 or hex 31)

Discussion When automatic overscore is enabled, all characters, including spaces, will be overscored until disabled.

Example The following sample program illustrates automatic overscoring and overscoring reset.

```
10 LPRINT "Control code ESC _ 1"
20 LPRINT CHR$(27);"_";CHR$(1);
30 LPRINT "enables automatic overscoring."
40 LPRINT "Control code ESC _ 0"
50 LPRINT CHR$(27);"_";CHR$(0);
60 LPRINT "disables automatic overscoring."
```

```
Control code ESC _ 1
enables automatic overscoring.
Control code ESC _ 0
disables automatic overscoring.
```

Print Mode/Pitch Selection

ASCII Code ESC X *mn* ESC [*nq*

Hex Code 1B 58 *mn* 1B 5B *n* 71

Dec Code 27 88 *mn* 27 91 *n* 113

Purpose Selects the print mode (DP, NLQ, DRAFT, or OCR) and character pitch in characters per inch (cpi).

where *For ESC[nq*:
n = Print Mode/Pitch code (values other than those shown in Table 5–8 are ignored); *q* = Command sequence terminator.

where *For ESC X mn:*
m = Print Mode code; *n* = Pitch (cpi).

An asterisk (*) (hex 2A) may be substituted for ***m*** or ***n***. Whenever the asterisk replaces ***m*** or ***n***, then its current value will not change. Values other than those shown in Table 5–9 and Table 5–10 are ignored.

NOTE: The print mode must be changed before the first printable symbol of a print line or the command sequence is deferred until the next line.

Discussion Print mode and pitch can also be selected from the operator panel. The print mode/pitch select control code from the host computer will override the operator panel print mode setting and the print mode and pitch selection will be reflected on the message display.

A complete set of tables identifying print modes, pitch, and dot densities for all print modes follows.

Table 5–8. Print Mode and Pitch (ESC [*nq*)

n	Print Mode and Pitch
1(31)	NLQ 10 cpi
2(32)	DP 10 cpi
3(33)	Draft 12 cpi
4(34)	DP 12 cpi
5(35)	DP 13 cpi

Table 5–9. Horizontal and Vertical Dot Density (ESC X)

m (Hex*)	Horizontal Density Resolution	Vertical Density	Discussion
0(30)	120 dpi	72 dpi	DP
1(31)	180 dpi	96 dpi	NLQ
2(32)	120 dpi	48 dpi	Draft
3(33)	120 dpi	48 dpi	Draft
4(34)	120 dpi	48 dpi	Draft
5(35)	120 dpi	144 dpi	OCR–A
6(36)	120 dpi	144 dpi	OCR–B
7(37)	120 dpi	72 dpi	DP
8(38)	120 dpi	72 dpi	DP

*The hex values shown (i.e., 0 and 30) are equal. Either value can be used in your program expression.

Table 5–10. Print Mode and Character Pitches (ESC X*mn*)

Characters per inch									
value of *n*:	**value of *m*:**								
Print Mode	**DP 0(30)**	**NLQ 1(31)**	**DRAFT 2(32)**	**DRAFT 3(33)**	**DRAFT 4(34)**	**OCR–A 5(35)**	**OCR–B 6 (36)**	**DP 7 (37)**	**DP 8 (38)**
0(30)	10	10	10	10	10	10	10	10	10
1(31)	12	12	12	12	12	–	–	–	–
2(32)	13	13	13	13	13	–	–	–	–
3(33)	15	15	15	15	15	–	–	–	–
4(34)	17	17	17	17	17	–	–	–	–

*The hex values shown (i.e., 0 and 30) are equal. Either value can be used in your program expression. The value of m is represented by the font choice line.

NOTE: When using the Multinational character set in OCR–A or OCR–B print mode, a unique character set is used.

Example Any of the BASIC expressions listed below will select the Data Processing print mode at 17.1 cpi.

where *m* (print mode) = 0 or 30 for Data Processing; and
n (pitch) = 4 or 34 for 17.1 cpi.

CHR$(27);"X";CHR$(0);CHR$(4);

CHR$(27);"X";CHR$(30);CHR$(34);

CHR$(27);"X04";

Printer Select

ASCII Code DC1

Hex Code 11

Dec Code 17

Purpose Places printer in the selected state.

Discussion When the configuration parameter PRINTER SELECT is enabled, this control code will allow the printer to receive and print data from the host.

Printer Deselect (code DC3) disables the printer from receiving data.

Printer Deselect

ASCII Code DC3

Hex Code 13

Dec Code 19

Purpose Places printer in the deselected state.

Discussion When the configuration parameter PRINTER SELECT is enabled, this control code will disable the printer from receiving and printing data from the host. Until a DC1 (Printer Select) command is received, all subsequent data to the printer is ignored.

NOTE: When the configuration parameter PRINTER SELECT is enabled and saved in the configuration, the printer will power up in the deselected state.

Skip–Over Perforation

ASCII Code ESC N *n*

Hex Code 1B 4E *n*

Dec Code 27 78 *n*

Purpose Selects the number of lines (at the current line spacing) for the paper to skip at the bottom of the perforated page.

where *n* = 1 to 127 to select the number of lines to skip. If the value of n exceeds the current form's length, it is ignored.

Discussion The actual distance set is the product of n and the current line spacing. Factory default value disables bottom margin. The current default value may be set by the operator. Setting a new forms length (ESC C) resets bottom margin to zero.

This feature is disabled whenever vertical tabs are set.

The bottom margin can also be selected from the operator panel; however, vertical tabs within the bottom margin zone, as set by the operator panel, are ignored. The control code bottom margin setting from the host computer will override the operator panel setting.

Skip–Over Perforation Cancel

ASCII Code ESC O (alpha O)

Hex Code 1B 4F

Dec Code 27 79

Purpose Resets bottom margin to zero.

Superscript/Subscript Printing

ASCII Code ESC S *n*

Hex Code 1B 53 *n*

Dec Code 27 83 *n*

Purpose Selects superscript or subscript printing.

where *n* = 0 to enable superscript printing (hex 00 or hex 30)
n = 1 to enable subscript printing (hex 01 or hex 31)

Discussion Superscript and subscript characters print at the same size as the current font. They are shifted up or down one half of a line. When the super/subscript control code is received, all characters will be superscript or subscript until reset by the super/subscript reset control code or printer reset. Emphasized print is ignored in the super/subscript print mode.

Both superscript and subscript characters can be printed in the same character column using the Backspace (BS) control code (page 5–13).

Caution should be used when combining Superscript or Subscript printing with other print attributes such as Elongated (Double High), or small line spacing; overlapping lines may occur. Characters with different horizontal or vertical dot densities will not overlap.

Example The following sample program illustrates superscript/subscript printing.

```
10 LPRINT "Control Code ESC S 0 selects";
20 LPRINT CHR$(27);"S";CHR$(0);" SUPERSCRIPT";CHR$(27);"T"
30 LPRINT "A";CHR$(27);"S";CHR$(0);"2";CHR$(27);"T";
40 LPRINT "+B";CHR$(27);"S";CHR$(0);"2";CHR$(27);"T";
50 LPRINT "=C";CHR$(27);"S";CHR$(0);"2";
60 LPRINT CHR$(27);"T"
70 LPRINT "Control Code ESC S 1 selects";
80 LPRINT CHR$(27);"S";CHR$(1);" SUBSCRIPT";CHR$(27);"T"
90 LPRINT "31";CHR$(27);"S";CHR$(1);"HEX";CHR$(27);"T";
100 LPRINT " 49 ";CHR$(27);"S";CHR$(1);"DEC";
110 LPRINT CHR$(27);"T"
120 LPRINT "Control Code ESC T cancels"
130 LPRINT "superscript/subscript printing."
```

```
Control Code ESC S 0 selects SUPERSCRIPT
A2+B2=C2
Control Code ESC S 1 selects SUBSCRIPT
31HEX 49 DEC
Control Code ESC T cancels
superscript/subscript printing.
```

Superscript/Subscript Printing Reset

ASCII Code ESC T

Hex Code 1B 54

Dec Code 27 84

Purpose Resets superscript and subscript printing as set by ESC S.

Underline

ASCII Code ESC – *n*

Hex Code 1B 2D *n*

Dec Code 27 45 *n*

Purpose Enables or disables automatic underlining of all characters.

where *n* = 0 to disable automatic underlining (hex 00 or hex 30)
n = 1 to enable automatic underlining (hex 01 or hex 31)

Discussion When automatic underline is enabled, all characters, including spaces, will be underlined until disabled.

Example The following sample program illustrates automatic underlining and underlining reset.

```
10 LPRINT "Control code ESC -1"
20 LPRINT CHR$(27);"-";CHR$(1);
30 LPRINT "enables automatic underlining."
40 LPRINT "Control code ESC -0"
50 LPRINT CHR$(27);"-";CHR$(0);
60 LPRINT "disables automatic underlining."
```

```
Control code ESC -1
enables automatic underlining.
Control code ESC -0
disables automatic underlining.
```

Vertical Tab

ASCII Code VT

Hex Code 0B

Dec Code 11

Purpose Prints the data in the buffer and advances the paper to the next vertical tab position.

Discussion Vertical tab positions are set by control code ESC B and executed by control code VT. In this mode, if vertical tabs are loaded, the paper position moves to the next vertical tab position.

If a vertical tab format is not defined, the paper position is advanced to the next line at the current line spacing. If a vertical tab format is defined but no vertical tab positions are set between the current print position and the end of the form, the paper position is advanced to the top of the next form. The VT code resets all single line print attributes. More information on vertical tabs is provided in Chapter 8.

Vertical Tab, Set/Clear

ASCII Code ESC B *n1 n2 n3...nk* NUL

Hex Code 1B 42 *n1 n2 n3...nk* 00

Dec Code 27 66 *n1 n2 n3...nk* 0

Purpose Sets vertical tab positions.

Expression CHR$(27);"B";CHR$(*n1*);...CHR$(*nk*);CHR$(0);

where *n1* through *nk* specify the line number for the vertical tab(s), for a maximum of 16 tab positions. CHR$(0) must be used as the sequence terminator.

Discussion The physical position on the paper is the product of *n* and the current line spacing. Subsequent line spacing changes do not change the tab position. If the value of *n* defines a tab stop that exceeds the forms length, that tab position is ignored.

In the Serial Matrix printer protocol, vertical tab positions are set by control code ESC B and executed by control code VT. The tab positions must be in ascending order or the sequence will terminate. More information regarding Serial Matrix vertical tab setting is provided in Chapter 8. If the ESC B command is followed immediately by NUL, the vertical tab positions are cleared.

Example The following sample program illustrates Vertical Tab Setting.

NOTE: The first line of the following example (10 LPRINT "Control code" represents line 1. If you run the program first (instead of the listing), your print out will look different from the example.

```
10 LPRINT "Control code"
20 LPRINT "ESC B 15 20 0 sets a vertical tab at line 15 and at line 20."
30 LPRINT CHR$(27);"B";CHR$(15);CHR$(20);CHR$(0);
40 LPRINT "Control code VT moves paper to the next vertical tab."
50 LPRINT CHR$(11);
60 LPRINT "Control code VT moves paper to the next vertical tab."
70 LPRINT CHR$(11);
80 LPRINT "This is line twenty."
```

```
Control code
ESC B 15 20 0 sets a vertical tab at line 15 and at line 20.
Control code VT moves paper to the next vertical tab.

Control code VT moves paper to the next vertical tab.



This is line twenty.
```

6 P–Series XQ Variant Printer Emulation

Chapter Contents

Overview

This chapter describes the P–Series XQ Variant emulation host control codes that are supported for IBM 6400 ASCII printers. Emulation refers to the ability of a printer to execute the commands of a particular printer control language. A printer control language is the coding system used to convey, manipulate, and print data. Carriage Return, print quality, character attributes such as bold and underline, margins, and tabs are typical functions selected by printer control language codes. In this manual, the terms emulation, printer protocol, and printer control language are synonymous.

The P–Series XQ Variant emulation was devised for a series of Printronix printers manufactured between 1974 and 1991, but no longer available. This emulation enables a 6400 printer to emulate Printronix P300 and P600 printers with A7/B10 boards. To select the P–Series XQ Variant emulation mode as the active printer configuration, refer to the ASCII Emulation Selection menu in Chapter 4 of the *IBM 6400 Line Matrix Printer Setup Guide* (S246–0116).

The P–Series XQ Variant emulation provides many configurable parameters. The default parameter values for this emulation are shown in Table 6–1. You can modify the emulation parameter values in two ways:

- **The P–Series XQ Variant host control codes.** An extensive set of P–Series XQ Variant control code commands can be sent to the printer from an attached host computer via the host data stream. Most of this chapter is devoted to describing the P–Series XQ Variant control codes.
- **The printer configuration menus.** You can modify a subset of the P–Series XQ Variant emulation parameters using the operator panel keys and LCD display, as described in the *Setup Guide.*

Control codes sent from a host system generally override previous settings that result from the configuration menus. However, any configuration settings from host control codes will be gone once the printer is powered off (or reset to the default values), unless you have saved them to NVRAM using the configuration menus. The *Setup Guide* describes the Save Custom Sets option for saving changes to your printer's NVRAM.

The emulation's response to several of the control codes depends on the configuration. For example, upon receipt of the carriage return control code, the emulation will either perform a carriage return function only, or a carriage return and line feed, based on the configuration for the CR function.

P-Series XQ Variant Default Values and States

Your printer's onboard memory stores a set of typical operating states and conditions for the P–Series XQ Variant emulation. When you power on the printer and select this emulation, the default settings in Table 6–1 are automatically invoked.

Table 6–1. P–Series XQ Default Settings

Characteristic	Default Setting
Control Code 06	8.0 LPI
Define CR Code	CR = CR
Auto LF	Disable
Define LF Code	LF = CR + LF
Compressed Print	Char 01 SOH
Elong./Alt Font	ELNG=BS FONT=SO
High Speed (Draft) Print Mode	Char 02 STX
EVFU Selected	Enable
Uppercase Select	Disable
Slew Relative	1–16 Lines

Table 6–2 lists several additional default settings for parameters that are provided by the Print Format menus (described in Chapter 4 of the *Setup Guide*). Many of the settings shown in Table 6–2 can be overridden by host control codes for the same parameter.

Table 6–2. Print Format Default Settings

Characteristic	Default Setting	
CPI	10.0	
LPI	6.0	
Forms Width	Inches Millimeters Characters	13.6 inches 345.4 mm 136 characters
Forms Length	Inches Millimeters Lines	11.0 inches 279 mm 66 lines
Print Quality	DP Quality	
Proportional Spacing	Disable	
Italic Print	Disable	
Slashed Zero	Disable	
Left Margin	0 columns	
Right Margin	0 columns	
Bottom Margin	0 lines	
Perforation Skip	Disable	

Configuring the XQ Variant Emulation with Control Codes

The remainder of this chapter describes the P–Series XQ Variant printer control language codes that may be sent from a host computer attached to the printer, in order to configure and invoke numerous printer functions.

Format for Control Code Descriptions

The following information is listed for each code function (where applicable and possible).

Name The title or function of the command.

ASCII Code The standard ASCII name for the control code.

Hex Code The code's numeric equivalent in hexadecimal.

Decimal Code The code's numeric equivalent in decimal.

Expression The control codes used in the BASIC programming language (where applicable).

Purpose The function(s) of the control code.

Discussion A description of exceptions or limitations to normal use.

Example A sample written in BASIC programming language is provided for some control codes when it is possible to illustrate the effect of a control code, or if a specific syntax is required to complete the program statement (i.e. Horizontal Tab set, Vertical Tab set/clear). The programs in this chapter were run on an IBM Personal Computer using Microsoft** GW-BASIC** version 3.22.

IMPORTANT

All print samples in this chapter were run on an impact printer that has a dot resolution of 1/60–inch horizontally and 1/72–inch vertically. Your printouts might look different from the samples provided in this printout, depending on the resolution of the printer in use.

WARNING: If you specify any parameters for a control code other than the ones that are defined in the control code description, unpredictable results may occur.

Edit Mode

NOTE: To use Edit mode in the XQ emulation, you must configure the printer for a carriage return only (CR = CR). If the printer is configured for a carriage return with a line feed (CR = CR + LF), the contents of the buffer print immediately after execution of the CR code, disabling the CR editing function.

Any printable character in the data stream can replace printable characters or spaces already loaded in the print buffer. The space character (20 hex) is used to skip characters in the print buffer that are not to be replaced and, similar to underlining or deleting, the new characters are inserted in the appropriate positions.

Figure 6–1 illustrates the edit mode. Note that the editing function replaces characters; it cannot be used to print the same character twice (double strike) in the same location. Use the DEL code (hex 7F) to make a character blank.

	Enter in Print Buffer	Printed Result
Example 1	AAABBBCCC(CR) S S S S D S S S B(LF)	AAABDBCCB
Example 2	ABCDEF(CR) _____(LF)	ABCDEF
Key:	S = Space (20 hex); LF = Line Feed (OA hex); CR = Carriage Return (OD hex)	

Figure 6–1. CR Edit Mode Example

NUL Code

NUL (Hex 00) is ignored by the printer and can be used as a fill character; however, it can not be used to add blank spaces since it is not a space character.

The Control Codes

This index lists each printer command by function, ASCII mnemonic, and the page where the command is explained in detail. "N/A" means not applicable. The rest of this chapter defines the control code functions for P–Series XQ Emulation mode. The commands are listed in alphabetical order.

NOTE: Channel codes 10 through 1F hex are used when the PI line is disabled. See Chapter 8 (EVFU) for applicable PI enable channel codes.

NOTE: The Compressed Print, Elongated Characters, and Shift Out parameters can be configured at the operator panel (see *6400 Setup Guide).*

FUNCTION	ASCII CODE	PAGE
Data Manipulation		
Delete	DEL	6–14
Space	Space	6–24
Graphics		
Plot, Even Dot	ENQ	6–22
Plot, Odd Dot	EOT	6–21

Alternate Character Set Deselect (Shift In)

ASCII Code SI

Hex Code 0F

Dec Code 15

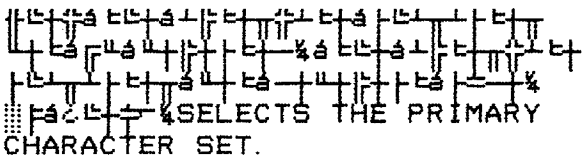
Purpose This code selects the primary character set.

Expression CHR$(15)

Discussion The alternate character set select and deselect codes can be used to mix primary and alternate characters on a single line. The main character set is also automatically selected when a line terminator code is received.

Example

```
10 LPRINT CHR$(14);
20 LPRINT "WHEN THE ALTERNATE CHARACTER"
30 LPRINT CHR$(14);
40 LPRINT "SET IS SELECTED, THE ALTERNATE"
50 LPRINT CHR$(14);
60 LPRINT "CHARACTER SET DESELECT CODE,"
70 LPRINT CHR$(14);
80 LPRINT "0F (HEX),";
90 LPRINT CHR$(15);
100 LPRINT "SELECTS THE PRIMARY"
110 LPRINT "CHARACTER SET."
```



Alternate Character Set Select (Shift Out)

ASCII Code SO, BS

Hex Code 0E, 08

Dec Code 14, 08

NOTE: An alternate hex code of 08 (ASCII code BS) can be assigned as the Alternate Character Set Select control code through printer configuration.

Purpose Accesses the extended character set in the range of A0 to FF hex using codes 20 to 7F hex.

Discussion These codes are used in 7–bit systems as if data bit 8 were set to 1. For example, sending code 20 hex accesses the symbol at code point A0 hex. If a printable symbol is not available at the code point, a space is printed. Both commands are cancelled by a paper motion command.

Example Please see next page.

```
10 LPRINT "THE ALTERNATE CHARACTER SET"
20 LPRINT "SELECT CODE, OE (hex),"
30 LPRINT CHR$(14);
40 LPRINT "SELECTS THE ALTERNATE"
50 LPRINT CHR$(14);
60 LPRINT "CHARACTER SET.  AFTER A LINE"
70 LPRINT CHR$(14);
80 LPRINT "TERMINATOR CODE OR A SHIFT IN,"
90 LPRINT CHR$(14);
100 LPRINT "OF (HEX),";
110 LPRINT CHR$(15);
120 LPRINT "THE PRIMARY CHARACTER SET"
130 LPRINT "IS RESELECTED."
```

```
THE ALTERNATE CHARACTER SET
SELECT CODE, OE (hex),
[illegible]THE PRIMARY CHARACTER SET
IS RESELECTED.
```

Carriage Return

ASCII Code CR

Hex Code 0D

Dec Code 13

Purpose Positions the logical print head at the left margin (resets the memory pointer to the first character position).

Expression CHR$(13)

Discussion The printer can be configured to perform a carriage return only (CR = CR only), or a carriage return plus a line feed function (CR = CR + LF).

A CR = CR configuration enables underline, add, delete, and edit functions, but the host computer must send a separate line feed code to print the data and change the vertical position. The character position indicator is positioned at character column one. Subsequent printable data preceding a paper motion command replaces previous printable data (including underlines). Two exceptions apply:

- Subsequent underlined characters (hex 5F) overlay the previous data.
- Subsequent space characters (hex 20) only index the character position indicator to the right.

This code can occur at any place in the data stream and is acted upon immediately. Note that this code can reduce the current print speed by up to one–fourth.

With CR = CR + LF, the underline, add, delete and edit functions are disabled, and the code is processed as a line feed. Refer to the Line Feed command description on page 6–19 for more information.

Compressed Print

ASCII Code SOH, ETX, HT

Hex Code 01, 03, 09

Dec Code 1, 3, 9

NOTE: Either SOH, ETX, or HT is defined at the operator panel as the code used to select Compressed Print (the default is SOH). (Refer to the configuration chapter of the *Setup Guide*.)

Purpose Selects compressed character printing.

Discussion Use the code defined at the operator panel to select 17.1 cpi.

These commands can occur anywhere in the data stream and are acted upon immediately, affecting the entire current print line. Line spacing may be selected either through the operator panel or by line spacing control codes. The control code setting overrides the operator panel line spacing setting.

ETX and HT can also be configured to select Draft font at 10 cpi (see page 6–23).

Example:

```
10 LPRINT "If the Compressed Print option"
20 LPRINT "is installed"
30 LPRINT "control code 01 (hex)"
40 LPRINT CHR$(1);
50 LPRINT "selects the standard compressed (17.1 cpi)"
60 LPRINT "for one line only."
```

```
If the Compressed Print option
is installed
control code 01 (hex)
selects the standard compressed (17.1 cpi)
for one line only.
```

Delete

ASCII Code DEL

Hex Code 7F

Dec Code 127

Purpose Deleted character puts a blank space at the corresponding character position.

Expression CHR$(127)

Discussion DEL deletes the corresponding character in the print buffer. In Figure 6–2 below, four delete control codes are used to delete DATE from the print line.

NOTE: The printer must be configured for carriage return only. If the printer is configured for a carriage return and line feed, the contents of the buffer are printed on receipt of the CR code.

Enter in Print Buffer	Printed Result
INVOICE DATE(CR) SSSSSSSSSSSDDDD(LF)	INVOICE
KEY S = Space (20 hex) CR = Carriage Return (0D hex)* D = Delete (7F hex) LF = Line Feed (0A hex)	

Figure 6–2. Delete Example

Electronic Vertical Format Unit (EVFU)

ASCII Code DLE through US

Hex Code 10 through 1F

Dec Code 16 through 31

NOTE: PI line is disabled in the above description. ASCII and corresponding codes for EVFU functions differ when the PI line is enabled, according to the printer interface being used.

Purpose Load and execute the EVFU.

Discussion Information about the EVFU is provided in Chapter 8

Elongated Characters(Double High Print)

ASCII Code BS, SO

Hex Code 08, 0E

Dec Code 8, 14

NOTE: Either BS or SO is defined at the operator panel as the code used to select Elongated Characters, Double High Print (the default is SO). (Refer to the configuration chapter of the *Setup Guide*.)

Purpose Selects elongated (double high) character printing for one line.

Discussion The Elongated Character control code can be placed anywhere in the data line before the line terminator. Following the line terminator, the printer automatically selects the default font. Consequently, the Elongated Character control code must be sent for each line of elongated characters. Elongated characters cannot be mixed with standard characters on the same print line.

The current line spacing is doubled for one line.

This code can occur anywhere in the data stream and is acted upon immediately. It is cancelled by a SI code or a paper motion command.

Example

```
10 LPRINT "Control code 08 (hex) selects"
20 LPRINT CHR$(8);
30 LPRINT "elongated character printing"
40 LPRINT CHR$(8);
50 LPRINT "for one line..."
60 LPRINT "and then the default print mode"
70 LPRINT "is reselected automatically."
```

```
Control code 08 (hex) selects
elongated character printing
for one line...
and then the default print mode
is reselected automatically.
```

Form Feed

ASCII Code FF

Hex Code 0C

Dec Code 12

Purpose Prints the data in the buffer, advances the paper position to the next top–of–form and moves the logical printhead to the first character column.

Discussion The default forms length is determined by the configuration in nonvolatile memory. Forms length is set by using the operator panel or VFU. Code FF cancels all single–line only print attributes.

The default form length is eleven inches. The Form Feed command reacts differently when the VFU is active. More information on VFU is provided in Chapter 8.

Line Feed

ASCII Code LF

Hex Code 0A

Dec Code 10

Purpose Prints the data in the buffer (if any) and advances the vertical character position one line at the current line space setting.

Discussion The logical print head is positioned at character column 1 of the new line. The LF function cancels all single line print attributes such as double high (elongated) and double wide (expanded) characters.

In the P–Series XQ Even Dot Plot mode (high density graphics), the LF code does not cause paper position motion; the data in the buffer is plotted and the logical print head is positioned at character column 1 in anticipation of the Odd Dot Plot control code to complete high density graphic plotting.

In the P–Series XQ Odd Dot Plot mode (normal density graphics), the LF code plots the data in the buffer, advances the paper position a single dot row at the current vertical dot density, and positions the logical print head at character column 1.

Line Spacing (8 or 10.3 LPI)

ASCII Code ACK

Hex Code 06

Dec Code 6

Purpose Selects line spacing of 1/8" or 7/72" for current line only.

Expression CHR$(6)

Discussion The line spacing control code can be placed anywhere in the data stream before the line terminator code; however, it is recommended that you place the line spacing code at the start or end of the data line.

After the line is printed at the new line spacing, the default line spacing is automatically reselected.

Example

```
10 LPRINT"The 8 LPI Control Code, 06(hex),"
20 LPRINT CHR$(6);
30 LPRINT "selects 8 lpi spacing"
40 LPRINT "for one line only."
```

```
The 8 LPI Control Code, 06(hex),
selects 8 lpi spacing
for one line only.
```

Plot, Even Dot (P–Series XQ High Density Graphics)

ASCII Code EOT

Hex Code 04

Dec Code 4

Purpose Selects even dot plot mode to print dots in even numbered dot columns to produce high density plotting.

Expression CHR$(4)

Discussion This control code can occur anywhere in the data line before the line terminator, but for best performance it should be placed at the beginning of the line. This command is acted upon immediately, affecting the entire current print line. It defines certain data between the next and last paper motion commands as even dot plot data. These data are plotted at 60" by 72".

When this mode is exited, the print mode and attributes last selected remain active. A detailed description of plotting can be found in Chapter 7.

You can set line spacing either through the operator panel or by line spacing control codes. A control code setting overrides the operator panel line spacing setting.

Example

```
10 LPRINT "EVEN AND ODD DOT PLOT" : LPRINT
20 LPRINT CHR$(4);"??????@@@@@@??????"
30 LPRINT CHR$(5);"??????@@@@@@??????"
40 FOR I=1 TO 36
50 LPRINT CHR$(4);"A@@@@ @@@@@@A@@@@ "
60 LPRINT CHR$(5);"A@@@@ @@@@@@A@@@@ "
70 NEXT I
80 LPRINT CHR$(4);"??????@@@@@@??????"
90 LPRINT CHR$(5);"??????@@@@@@??????"
```

```
EVEN AND ODD DOT PLOT
```

Plot, Odd Dot (P–Series XQ Normal Density Graphics)

ASCII Code ENQ

Hex Code 05

Dec Code 5

Purpose Selects odd dot plot mode to print dots in odd numbered dot columns for normal density plotting.

Expression CHR$(5)

Discussion This control code can occur anywhere in the data line before the line terminator, but for best performance it should be placed at the beginning of the line. This command is acted upon immediately, affecting the entire current print line. It defines certain data between the next and last paper motion commands as odd dot plot data. These data are plotted at 60" by 72".

When you exit this mode, the font and attributes last selected remain active. Plotting is described in Chapter 7.

You can set line spacing either through the operator panel or by line spacing control codes. A control code setting overrides the operator panel line spacing setting.

Example

```
10 LPRINT "ODD DOT PLOT" : LPRINT
20 LPRINT CHR$(5);"??????@@@@@@??????"
30 FOR I=1 TO 36
40 LPRINT CHR$(5);"A@@@@ @@@@@@A@@@@ "
50 NEXT I
60 LPRINT CHR$(5);"??????@@@@@@??????"
```

```
ODD DOT PLOT
```

Select Draft Print

ASCII Code STX, ETX, HT

Hex Code 02, 03, 09

Dec Code 2, 3, 9

Purpose Selects Draft 10 cpi as the font.

NOTE: Either STX, ETX, or HT is selected at the operator panel as the code that selects High Speed (Draft) Print Mode; the default is STX. (See the Configuration chapter in the *Setup Guide*.)

Discussion Once the control code for High Speed (Draft) Print Mode has been defined from the operator panel, that code can then select Draft 10 cpi.

These commands can occur anywhere in the data stream and are acted upon immediately, affecting the entire current print line. You can set line spacing either through the operator panel or by line spacing control codes. A control code setting overrides the operator panel line spacing setting.

ETX and HT can also be configured to select Compressed Print (17.1 cpi) if you configure the printer from the operator panel. (See page 6–13.)

Example

```
10 LPRINT "CONTROL CODE 02 SELECTS"
20 LPRINT CHR$(2);
30 LPRINT "DRAFT PRINT MODE FOR ONE LINE ONLY"
40 LPRINT "JUST EXITED DRAFT MODE BY EXECUTING A LF"
```

```
CONTROL CODE 02 SELECTS
DRAFT PRINT MODE FOR ONE LINE ONLY
JUST EXITED DRAFT MODE BY EXECUTING A LF
```

Space

ASCII Code SP

Hex Code 20

Dec Code 32

Purpose Produces a blank space; no character is printed.

Expression CHR$(32)

Discussion It is not necessary to pad the end of the print line with space characters. The printer automatically fills the line after the line terminator is received.

The Space character code is also used to skip characters for editing and underlining. ("Edit Mode," page 6–6.)

Underline

ASCII Code Underline key (_)

Hex Code 5F

Dec Code 95

Purpose Underlines specified character positions.

Expression CHR$(95)

Discussion To underline characters, the print buffer is first loaded with the character line; then the line must be terminated with a Carriage Return code. Spaces are then loaded in the buffer at positions not to be underlined, and the underline code is inserted in the specific positions to be underlined. Figure 6–3 illustrates underlining.

Enter in Print Buffer	Printed Result
THE 600 PRINTER (CR) SSSS____(LF)	THE 600 PRINTER
KEY: LF = Line Feed (OA hex) CR = Carriage Return (OD hex)*	_ = Underline (5F hex) S = Space (20 hex)

Figure 6–3. Underline Example

Vertical Tab

ASCII Code VT

Hex Code 0B

Dec Code 11

Purpose Acts as a line terminator when the EVFU is loaded, causing the paper to advance to a specified programmed line.

Expression CHR$(11)

Discussion Vertical Tab is primarily an EVFU line terminator code as described in the Electronic Vertical Format Unit. If the EVFU is not loaded and Vertical Tab control code is used, a single line feed occurs.

7 Graphics

Chapter Contents

Overview

This chapter explains how the printer produces graphic images.

The quickest way to produce graphic images is to use one of the many graphics software applications available. Any graphics program that is compatible with the Epson FX, Proprinter III XL, P-Series, Serial Matrix, or P-Series XQ Variant emulation should provide excellent results.

You can also use the Intelligent Graphics Processor (IGP*) Printronix emulation or the Code V* Printronix emulation. Both allow you to create and store forms, generate logos, bar codes, expanded characters, and other graphics.

Printing text and characters is the default mode of operation. However, your printer can print graphics.

- When the emulation is in the Proprinter III XL, Epson, or Serial Matrix protocol mode, Bit Image graphics is used for graphics printing.
- When the emulation is in the P–Series or P–Series XQ Variant protocol mode, Odd/Even dot plotting is used for graphics printing.

Each line of graphics data must include a graphics control code to enable the emulation for the desired graphics mode of operation.

Bit Image Graphics

When the printer uses the IBM Proprinter III XL, Epson, or Serial Matrix emulation, it creates graphics by accepting bit image graphics data.

NOTE: Text and graphics can be mixed on the same line when the printer plots bit images in the Epson or Proprinter III XL emulation.

Bit image graphics are created by vertically printing the bit pattern of a series of data bytes. For example, the bit pattern of the ASCII character A (hex 41, decimal 65) is shown in Figure 7–1. If we rotate this data byte 90 degrees clockwise, we have a vertical data byte with the most significant bit (MSB) at the top. If we then print each 1 (true) bit as a dot, the result is a “bit image” plot of the ASCII character A.

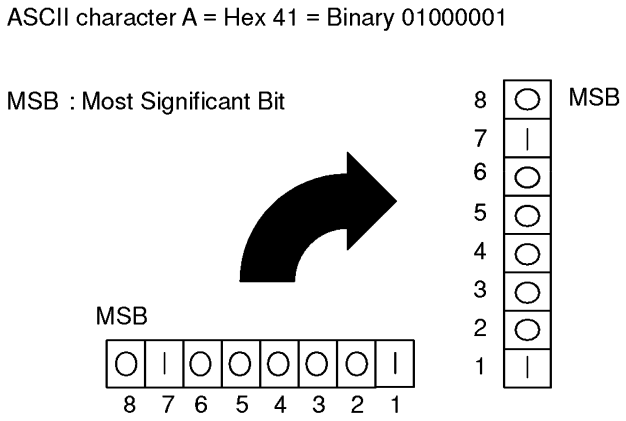


Figure 7–1. Vertical Data Byte Pattern

The relationship between the ASCII character, its decimal value, and its bit image plot is shown in Figure 7–2. All 8 bits of the data byte are used in all fonts, but some fonts have taller and shorter characters. (You may have to adjust the line spacing in order to print without horizontal gaps.) Data bytes are identified by their binary, octal, hexadecimal, or decimal equivalents. These numeric equivalents are combined in data streams to form graphic patterns such as the one illustrated in Figure 7–3.

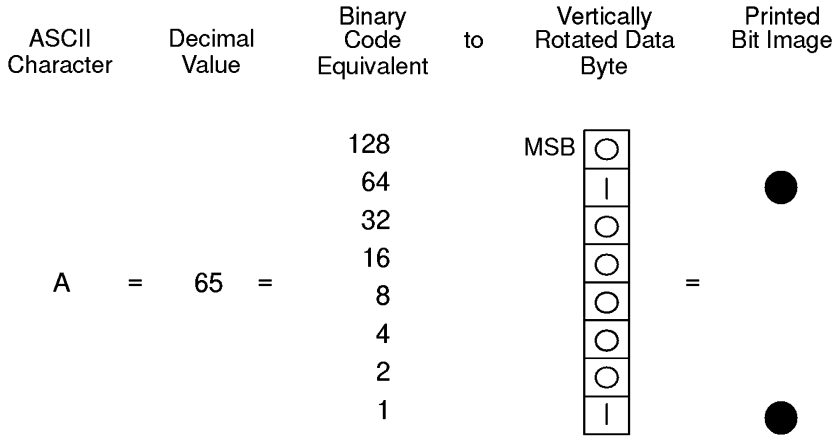


Figure 7–2. Bit Image Pattern from an ASCII Character

Bit Image plotting is not limited to printable ASCII characters. You can print Bit Image patterns for any 8-bit data byte with decimal values ranging from 0 to 255. (The ASCII character set is charted in Appendix C.)

Designing a Bit Image Pattern

A Bit Image pattern is produced in four steps:

1. On a quadrille pad or graph paper, lay out the graphic pattern you want to print. (See Figure 7–3.)
2. Determine the decimal equivalent of each vertical data byte in your pattern. (The sum of the decimal equivalent of each true bit in the vertical data byte is the decimal equivalent of the data byte.)
3. Write a program to generate the pattern.
4. Enter and run the program on the host computer.

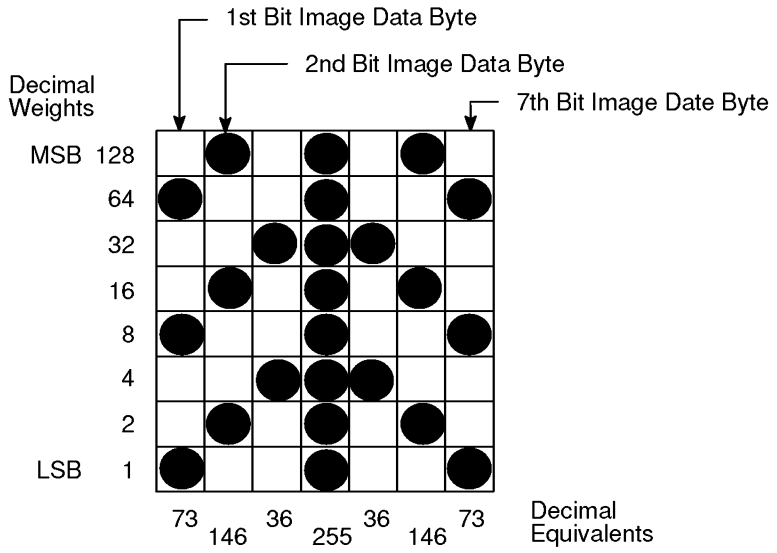


Figure 7–3. Bit Image Pattern Plan

Bit Image Density

You can print bit image graphics in different dot densities. Select dot densities by sending a control code in the data stream:

NOTE: Every line of graphics data must include the necessary plot mode command so the printer can perform the chosen graphics functions.

Single Density Mode: ESC K

Single density bit image graphics in a Data Processing (DP) print quality are printed at 60 dots per inch (dpi) horizontally and 72 dpi vertically. For NLQ print quality, the horizontal dot density is 90 dpi and vertical dot density is 96 dpi. For High Speed (HS) draft print quality, horizontal dot density is 60 dpi and vertical dot density is 48 dpi.

Double Density Mode: ESC L

Double density mode prints up to twice the number of dots per inch horizontally in the same space used for single density. The vertical dot density remains the same as in single density mode. Double horizontal density requires twice the number of input data bytes to print the same length line as single density. Printing double density reduces the printing speed by half.

Double Speed - Double Density Mode: ESC Y

When the double density - double speed control code is received, data bytes print at double the current horizontal dot density, but adjacent dots are not printed. Since double density graphics are printed at half speed, double speed - double density graphics are printed at the same speed as single density graphics. This mode is often used to position a simulated print head precisely by sending blank dot columns.

Quadruple Density Mode: ESC Z

When printing quadruple density graphics, the printer combines adjacent quadruple density bit image bytes. The compounded data are then printed in double density mode.

Bit Image Programming Format

The bit image command format is:

ESC CC (*n1*) (*n2*) DATA

where:

ESC	=	the serial matrix SFCC
CC	=	K, L, Y or Z to select dot density (K=single, L=double, Y=double density - double speed, Z=quadruple density)
n1	=	(Number of DATA bytes) - 256(*n2*)
n2	=	(Number of DATA bytes)/256
DATA	=	the dot pattern bytes

The syntax of the bit image expression must be correct.

The number of data bytes and the *n1*, *n2* definition must be equal.

Any characters following *n1* and *n2* are interpreted and plotted as data until the *n1*, *n2* definition is satisfied.

If *n1* = *n2* = 0, then control codes K, L, Y, or Z are ignored.

The maximum number of data bytes that can be included in the DATA portion of the program statement (when using 132 column paper) varies according to the dot density:

At 60 dpi, single density = 792 bytes
double density = 1584 bytes
quadruple density = 3168 bytes

Data that go past the right margin are discarded if automatic line feed is disabled. If automatic line feed is enabled, data that go past the right margin trigger an automatic line feed (LF) and are printed on the next line.

Bit Image Sample Program

The program below, written in BASIC, produces the single density bit image pattern shown in Figure 7–4. The 7-byte pattern is repeated 40 times. Depending on the host computer system, it may be necessary to add a width statement to the BASIC program.

```
10 WIDTH "lpt1:", 255
20 LPRINT "Single Density Bit Image Graphics"
30 LPRINT CHR$(27);"K";CHR$(24);CHR$(1);
40 FOR N=1 TO 40
50 RESTORE
60 FOR I=1 TO 7
70 READ R
80 LPRINT CHR$(R);
90 NEXT I
100 NEXT N
110 DATA 73, 146, 36, 255, 36, 146, 73
120 LPRINT
```

Figure 7–4. Sample Single-Density Bit Image Graphics

Plot Mode

Plot mode is available for the P–Series and P–Series XQ Variant protocols.

This subsection describes the P–Series compatible odd/even dot Plot mode of operation. The P–Series plot has a rigid format wherein each line of data contains a plot command code, the plot data, and an LF code (hex 0A).

The P–Series codes (hex 04 and 05, respectively) can be placed anywhere on the command line.

The P–Series XQ codes (hex 04 and 05, respectively) can also be placed anywhere on the command line without degrading plot speed.

When P–Series Plot mode is enabled by an EOT (hex 04) or ENQ (05) code, all control codes except LF, CR, and FF, are ignored. Any control sequence parameter prior to a plot code is acted upon immediately. Any control sequence parameter following an EOT or ENQ code is treated as plot data.

If any combination of EOT (hex 04) or ENQ (05) code is received in a single line, the priority of action is:

- EOT (hex 04) takes priority over ENQ (hex 05)
- ENQ has the same priority level and is acted upon in the order received

A printable symbol is defined as any character or command that might cause the head of a serial printer to move away from character column one.

Plot Density

Plot density refers to the number of dots per inch (dpi) printed in a single dot row. Two types of plot density are available with P–Series Plot mode graphics: normal density and high density. The densities can be mixed within the printed page on a dot row–by–row basis, but the two densities cannot be mixed on the same dot row.

Normal Density Plot Mode

Normal density plotting is selected with the odd dot plot control code ENQ (05 hex). The odd–numbered dot columns are addressed to produce a horizontal and vertical density that varies with the font selected:

- Data Processing (DP) = 60 dpi horizontal, 72 dpi vertical
- Near Letter Quality (NLQ) = 90 dpi horizontal, 96 dpi vertical
- High Speed Draft (HS) = 60 dpi horizontal, 48 dpi vertical

Figure 7–5 illustrates normal density dot plot.

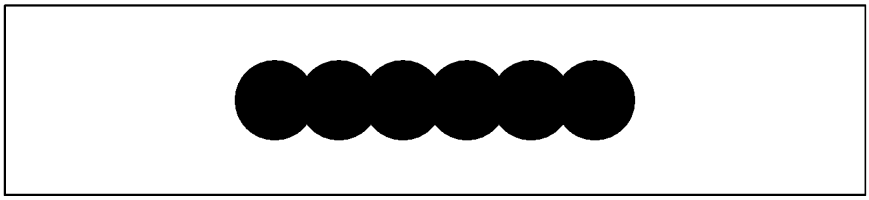


Figure 7–5. Normal Density Plot

Double Density Plot Mode

High density plotting is selected with the even dot plot control code EOT (04 hex) in conjunction with the odd dot plot control code ENQ (05 hex). The odd and even numbered dot columns are addressed to double the horizontal density. The vertical density remains the same in normal and high density plotting, though vertical density is based on the current print mode.

Figure 7–6 illustrates high density plotting.

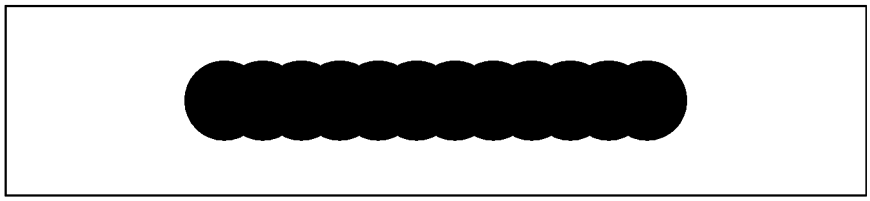


Figure 7–6. High Density Plot

Plot Data Byte Format

In P–Series/P–Series XQ Variant Plot Mode, the format is as follows:

- Each data byte specifies six out of twelve plot dot columns.
- Using odd dot plot mode, bits 1 to 6 of the data byte address the odd–numbered dot columns; using even dot plot mode, bits 1 to 6 of the data byte address the even–numbered dot columns.
- Bit 6 and/or bit 7 of the data byte must be a "1" (or true) bit in Plot mode.
- Bit 8 of the data byte is not used in the Plot mode and may be 1 or 0.
- The binary equivalent of the plot data bytes must be known to accurately address specific dot positions.

As shown in Figure 7–7, a dot is printed at the location addressed by each of bits 1 to 6 in the data byte that is set (1 or true).

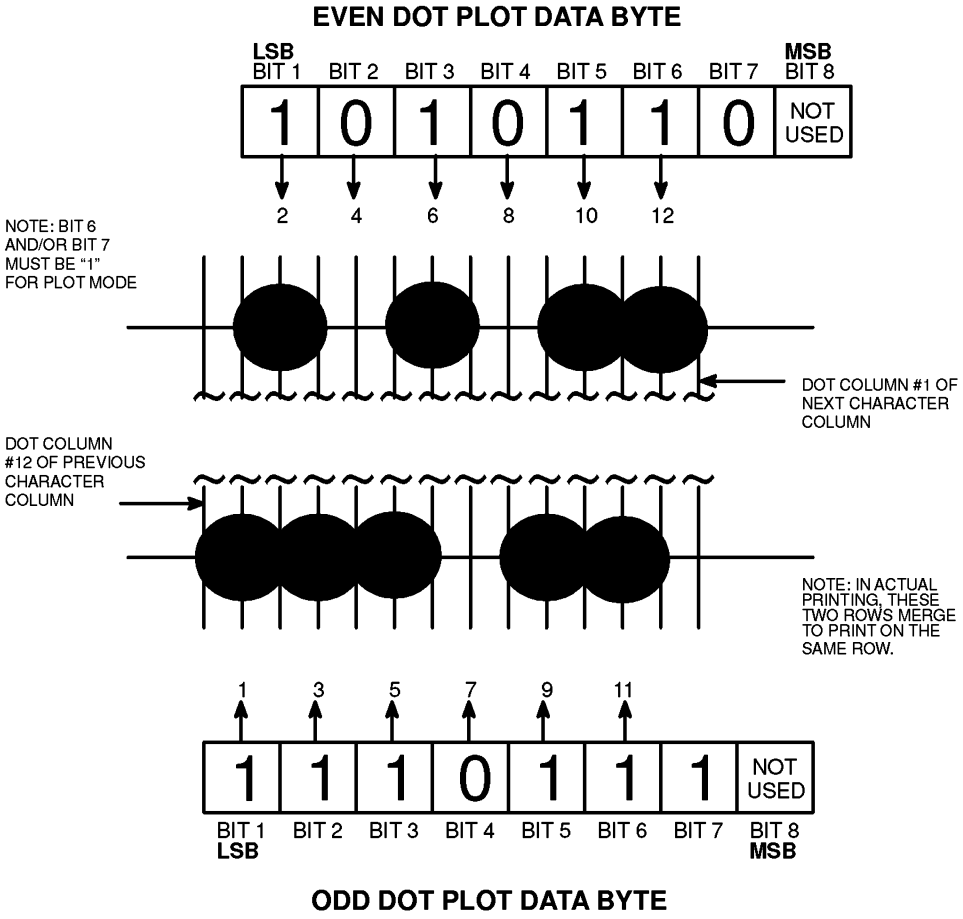


Figure 7–7. P–Series/P–Series XQ Variant Plot Data Byte Format

Plot Data Line Format

A P–Series plot data line contains the following: (See Figure 7–8.)

- The plot mode control code: either 05 hex for normal density, or 04 hex (even dot plot) combined with 05 hex (odd dot plot) for double density plotting.
- The data bytes to be plotted.
- The line terminator 0A hex or 0C hex.
- With print width set to 13.2 inches, a plot data line may contain any number of bytes up to a maximum of 132 for horizontal dot density of 60 dpi (DP font) or 198 bytes for a horizontal dot density of 90 dpi (NLQ font).
- A plot data line may contain any number of data bytes up to the maximum. If automatic line feed is disabled, any bytes over the maximum are lost. If the maximum is exceeded and automatic line feed is enabled, a line feed (LF) is forced and the remaining plot data are printed as text on the next line.
- The plot mode command may occur anywhere in the line, but plot speed may decrease if it is not at the beginning of the line.

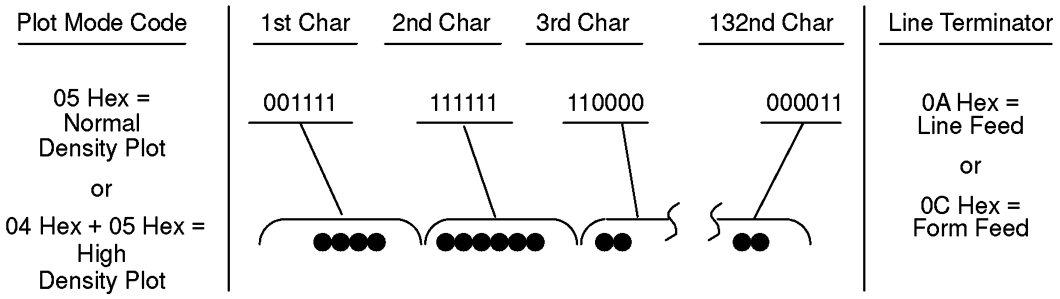


Figure 7–8. Plot Data Line Format

Normal Density Plot Mode Format:

For normal density plot, the plot line contains: Control Code 05 hex, plot data bytes, and a Line Terminator (0A hex or 0C hex). The control sequence for sending the P–Series Normal Density Plot is as follows:

1. Send the plot command code ENQ (05 hex).
2. Send the plot data bytes (refer to Table 7–1 on page 7–17).
3. Send a line terminator, either a Line Feed (LF, 0A hex) or a Form Feed (FF, 0C hex). A Carriage Return (CR) may also be used instead of the LF code, provided the Carriage Return has been configured for Carriage Return = Carriage Return + Line Feed (CR = CR + LF).
    a. A line feed (0A hex) used as the line terminator plots the contents of the buffer and advances the paper position a single dot row, based on the vertical density of the current mode.
    b. A form feed (0C hex) used as the line terminator plots the contents of the buffer and advances the paper to the next TOF.
4. Regardless of which line terminator code is sent, the emulation will default to the previously selected print mode (font) unless further plot control codes are provided with the data.

Double Density Plot Mode Format:

For double density plot, the plot line contains: Control Code 04 hex, plot data bytes, a Line Terminator (0A hex or 0C hex), Control Code 05 hex, plot data bytes, and a Line Terminator. The control sequence for sending P–Series Double Density Plot is as follows:

1. Send the even dot plot control code EOT (04 hex), followed by plot data bytes (refer to Table 7–1 on page 7–17).

2. Send a line terminator, which causes the printer to plot the data bytes; the paper position is *not* advanced in double density plot; the printer now waits for the second line of data.

3. Send the odd dot plot control code ENQ (05 hex) and a second line of data, followed by a line terminator.

    a. A line feed (0A hex) used as the line terminator plots the contents of the buffer and advances the paper position a single dot row, based on the vertical density of the current mode. A CR (if CR = CR + LF is configured) may also be used with the same result.

    b. A form feed (0C hex) used as the line terminator plots the data bytes and advances the paper position to the next TOF.

4. Regardless of which line terminator code is sent, the emulation will default to the previously selected print mode (font) unless further plot control codes are provided with the data.

Plotting the Data

P–Series Plot Mode plots the image from the horizontal bit pattern. Figure 7–9 duplicates the pattern shown in Figure 7–3 but is modified for Odd Dot Plot. Eight dot rows are required, two characters per row, six columns per character.

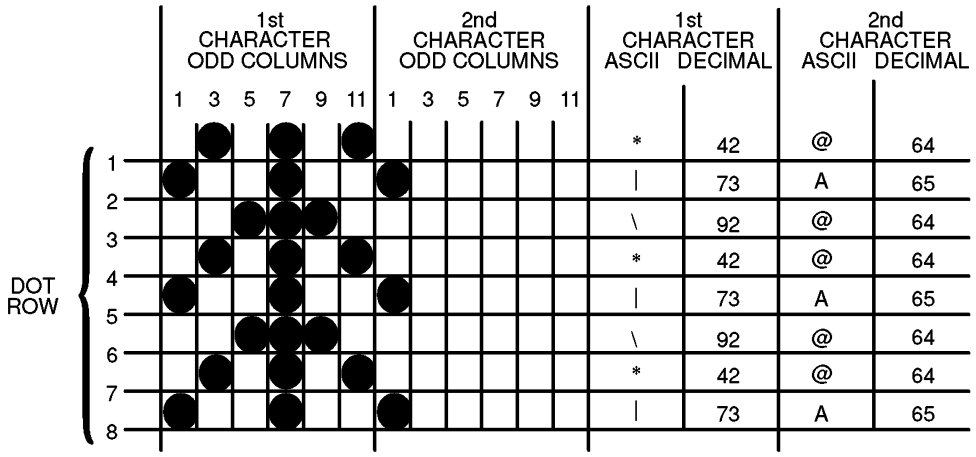


Figure 7–9. Odd Dot Plot Pattern Plan

The following program uses the Odd Dot Plot control code to produce the image. The image is printed 25 times as shown in Figure 7–10. An entire dot row is plotted in one printing pass. Consequently, the first row of all 25 images is printed in one pass, followed by the second row, etc., until all rows have been printed.

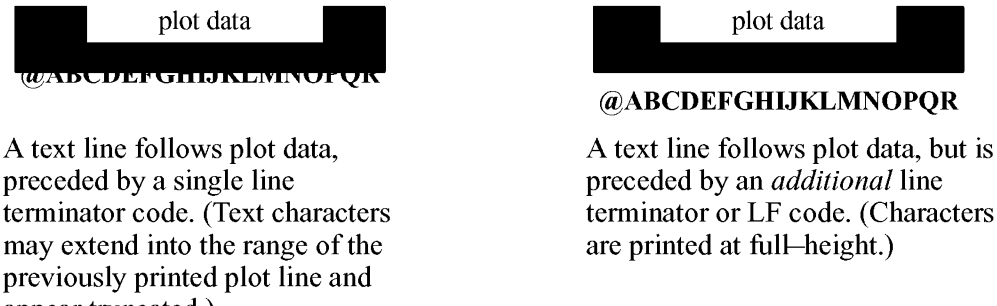
```
10  LPRINT "Odd Dot Plot"
20  FOR I=1 TO 8
30  READ R1
40  READ R2
50  LPRINT CHR$(5);
60  FOR N=1 TO 25
70  LPRINT CHR$(R1);CHR$(R2);
80  NEXT N
90  LPRINT
100 NEXT I
110 DATA 42, 64, 73, 65, 92, 64, 42, 64, 73, 65, 92, 64,
42, 64, 73, 65
120 LPRINT
```

```
Odd Dot Plot
```

Figure 7–10. Sample Odd Dot Plot

Exiting from P–Series/P–Series XQ Variant Plot Mode

When returning to the print mode from the P–Series Plot Mode, an extra line feed should be included in the data stream to maintain proper print line registration relative to the last line of plot graphics. If the extra line feed is not included, the first character line after the graphics data may be truncated, as shown in Figure 7–11.



A text line follows plot data, preceded by a single line terminator code. (Text characters may extend into the range of the previously printed plot line and appear truncated.)

A text line follows plot data, but is preceded by an *additional* line terminator or LF code. (Characters are printed at full–height.)

Figure 7–11. Truncated Character Line

Combining Graphics and Text

You can combine graphics and characters (text) on the same page in two ways:

- Use Bit Image graphics or Plot mode to produce characters as well as graphics
- A combination of text (not plot) and graphics can be mixed on the same page within all protocols.

Text and graphics can be mixed on the same line, however, only by using the Bit Image graphics in the Serial Matrix, Epson, or Proprinter XL protocols.

Any character or symbol can be created in the Plot mode or with Bit Image graphics simply by addressing and plotting the appropriate dot positions.

Either Bit Image or Plot mode graphics can be mixed with text within the page on a line by line basis. Each line of graphics data must include a graphics control code or the emulation will automatically default to the print mode. Using Bit Image graphics, it is possible to use the print mode to produce text on one print pass followed by a print pass to produce graphics on the same line; however, text characters can be affected by the Bit Image data when combined on the same line.

Table 7–1 on the following page 7–17 shows the plot data byte dot patterns that are referenced in the description of P–Series plot mode on page 7–11.

Table 7–1. Plot Data Byte Dot Patterns

BINARY	OCT	DEC	HEX	ASCII	2 4 6 8 10 12 1 3 5 7 9 11	BINARY	OCT	DEC	HEX	ASCII	2 4 6 8 10 12 1 3 5 7 9 11	BINARY	OCT	DEC	HEX	ASCII	2 4 6 8 10 12 1 3 5 7 9 11
0100000	040	32	20	Space		1000000	100	64	40	@		1100000	140	96	60	‘	
0100001	041	33	21	!		1000001	101	65	41	A		1100001	141	97	61	a	
0100010	042	34	22	”		1000010	102	66	42	B		1100010	142	98	62	b	
0100011	043	35	23	#		1000011	103	67	43	C		1100011	143	99	63	c	
0100100	044	36	24	$		1000100	104	68	44	D		1100100	144	100	64	d	
0100101	045	37	25	%		1000101	105	69	45	E		1100101	145	101	65	e	
0100110	046	38	26	&		1000110	106	70	46	F		1100110	146	102	66	f	
0100111	047	39	27	’		1000111	107	71	47	G		1100111	147	103	67	g	
0101000	050	40	28	(		1001000	110	72	48	H		1101000	150	104	68	h	
0101001	051	41	29	)		1001001	111	73	49	I		1101001	151	105	69	i	
0101010	052	42	2A	*		1001010	112	74	4A	J		1101010	152	106	6A	j	
0101011	053	43	2B	+		1001011	113	75	4B	K		1101011	153	107	6B	k	
0101100	054	44	2C	,		1001100	114	76	4C	L		1101100	154	108	6C	l	
0101101	055	45	2D	–		1001101	115	77	4D	M		1101101	155	109	6D	m	
0101110	056	46	2E	.		1001110	116	78	4E	N		1101110	156	110	6E	n	
0101111	057	47	2F	/		1001111	117	79	4F	O		1101111	157	111	6F	o	
0110000	060	48	30	0		1010000	120	80	50	P		1110000	160	112	70	p	
0110001	061	49	31	1		1010001	121	81	51	Q		1110001	161	113	71	q	
0110010	062	50	32	2		1010010	122	82	52	R		1110010	162	114	72	r	
0110011	063	51	33	3		1010011	123	83	53	S		1110011	163	115	73	s	
0110100	064	52	34	4		1010100	124	84	54	T		1110100	164	116	74	t	
0110101	065	53	35	5		1010101	125	85	55	U		1110101	165	117	75	u	
0110110	066	54	36	6		1010110	126	86	56	V		1110110	166	118	76	v	
0110111	067	55	37	7		1010111	127	87	57	W		1110111	167	119	77	w	
0111000	070	56	38	8		1011000	130	88	58	X		1111000	170	120	78	x	
0111001	071	57	39	9		1011001	131	89	59	Y		1111001	171	121	79	y	
0111010	072	58	3A	:		1011010	132	90	5A	Z		1111010	172	122	7A	z	
0111011	073	59	3B	;		1011011	133	91	5B	[		1111011	173	123	7B	{	
0111100	074	60	3C	<		1011100	134	92	5C	\		1111100	174	124	7C	|	
0111101	075	61	3D	=		1011101	135	93	5D	]		1111101	175	125	7D	}	
0111110	076	62	3E	>		1011110	136	94	5E	^		1111110	176	126	7E	~	
0111111	077	63	3F	?		1011111	137	95	5F	—		1111111	177	127	7F	Delete	

8 Vertical Page Formatting

Chapter Contents

Overview

Rapid vertical paper movement is called slewing. A vertical format unit (VFU) is a program you load into the printer that enables it to slew paper to preset locations on a page.

On your printer, LF commands and other commands that produce blank lines are accumulated and moved in one efficient paper motion. The VFUs are maintained for compatibility with earlier applications.

Following an introductory overview of how to plan a vertical page format, the following three methods of vertical formatting are described in this chapter:

- **Vertical tab table:** The IBM Proprinter III XL, Epson FX, and Serial Matrix emulations each contain a vertical tab table. It is a set of programmed vertical tabs.
- **Electronic Vertical Format Unit (EVFU):** The P–Series and P–Series XQ Variant emulations provide the EVFU capability.

Planning a Vertical Page Format

Vertical page formatting with a VFU such as the EVFU consists of four steps:

1. Select the type of vertical format you want to use. This is covered in the next section.
2. Design the form, determining the spacing and channel assignments for every line. Channel assignments are discussed in the VFU sections.
3. Determine the programming sequence. The format of the sequence depends on the type of VFU you select and is discussed in each VFU section of this chapter.
4. Send the programming sequence to the printer in the host data stream. This loads the VFU program.

Some VFUs require the PI line normally associated with the Dataproducts parallel interface.

VFU Characteristics

Keep in mind the following information when programming and using a VFU:

Elongated Characters - You can use elongated (double high) characters in VFU programs. The VFU automatically counts one line of elongated characters as two character lines.

VFU Not Loaded - If the VFU is not loaded, the printer performs a single line feed in response to VFU commands.

Paper Runaway Protection - If the VFU memory is loaded and a channel code is sent that was not previously loaded, the printer moves the paper a single line feed.

Line Spacing - The printer can use either 6 or 8 lines per inch (lpi) spacing. These VFUs calculate the forms length by line density selected. The 6 and 8 lpi spacing may be mixed on the same form, but should be done carefully.

Form Feed - A form feed sent from the operator panel or a command from the host moves the paper to the first channel 1, which is the top of form.

Vertical Tab - A VT command moves the paper to the next channel 12. If a channel 12 is not loaded, a line feed will occur.

Vertical Tab Table for Proprinter, Epson, and Serial Matrix

The IBM Proprinter III XL, Epson FX, and Serial Matrix emulations each contain a vertical tab table. It is a set of programmed vertical tabs. Various lines of the form are assigned vertical tabs, which are then accessed by control code for rapid paper advancement to the tab position.

Two control codes are used for vertical tabbing: ESC B sets single channel vertical tabs, and VT executes a vertical tab. These codes are described in Chapters 2, 3, and 5, which cover the Proprinter, Epson, and Serial Matrix emulations, respectively. The Epson emulation also has ESC / to select one of eight tab channels and ESC b to set the tabs in a particular channel.

Executing Vertical Tabs

The vertical tab execute code is VT. It prints the contents of the print buffer (if data are in the buffer) and causes paper movement to the next predefined vertical tab position. If a tab position is not defined, the paper is moved to the next line at the current line spacing. If a tab position is at the current line, the paper is moved to the next tab position. If no tab positions are defined between the current line and the end of the form, the paper moves to the next TOF.

Vertical Tab Positions

Vertical tab positions are set by line number. A maximum of 16 vertical tab positions can be set on the form. A sample format is shown in Figure 8–1.

The first vertical tab is set at line 6 for part number data, a second tab is set at line 8 for part name data, and a third tab is set at line 14 for quantity data. The ESC B code assigns the vertical tabs to the lines of the form. Once the tab positions are set, sending the vertical tab execute code (VT) causes the paper (currently at the top-of-form position) to advance to the first tab position for PART NUMBER data. Sending another VT moves the paper to the second tab position for PART NAME, followed by a third VT to access the third tab position for QUANTITY data.

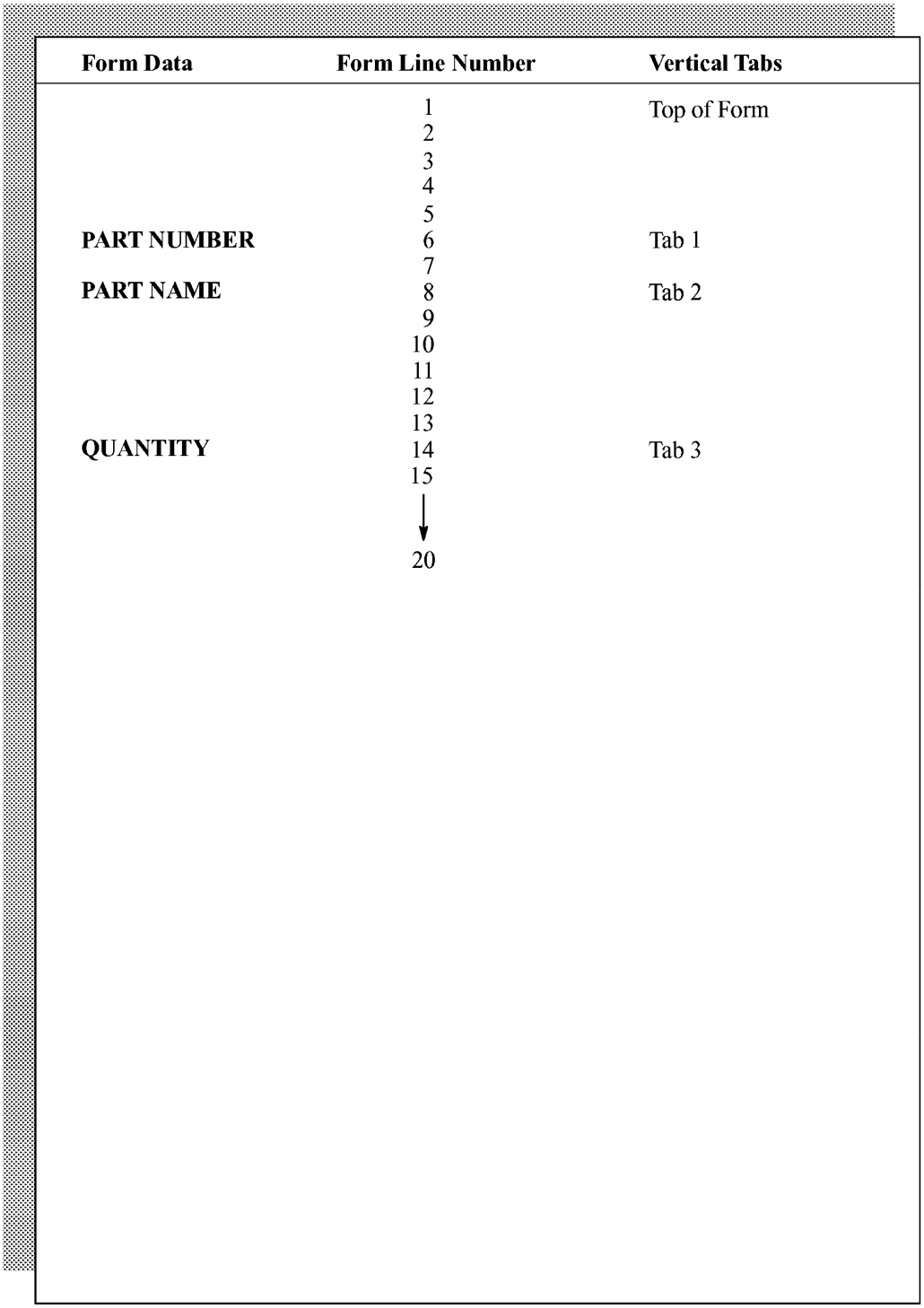


Figure 8–1. Example of Vertical Tab Positions

EVFU for P–Series and P–Series XQ Variant Emulations

The EVFU may be selected in P–Series or the P–Series XQ Variant protocol. The EVFU provides 14 or 16 channels to identify up to 192 lines depending on the paper instruction. The programming sequence is 1) start load code; 2) line identification code; and 3) end load code.

Start Load Code – 1E or 6E Hex

The start load code clears and initializes the EVFU memory for the memory load program. The start load code is 1E hex when the PI line is disabled (low) or 6E hex when the PI line is enabled (high).

Channel Assignment

The EVFU memory has the capacity for 192–line forms. The first line identification code (channel code) in the memory load program defines the first line on the form; the second line identification code defines the second line on the form, etc. Each line must have a line identification code. Filler channel codes are used for lines that will not be accessed by the print program. Any channel code can be used as a filler except channel code 1, which is reserved for the top–of–form, and channel code 12, which is reserved as the vertical tab channel. The same filler channel code can be repeated as necessary for any number of lines.

Channel 1 – The top–of–form code, reserved as the first line on the form or the first line printed (top–of–form position). The operating program sends the channel 1 code to advance to the top of the next form. After the memory is loaded, a Form Feed code (FF, 0C hex) will move the paper to the next channel 1 (top–of–form).

Channels 2 through 11, 13 and 14 – Used as general channel codes (line identification codes) or filler channels. Each line on the form must be identified by a channel code. When the operating program sends the channel code, the paper advances to the line identified by the channel code. Lines not used by the operating program must be identified by filler channels (unused channel codes).

Channel 12 – Reserved as the Vertical Tab channel. The Vertical Tab code (VT, 0B hex) prints any data in the print buffer and rapidly slews the paper to the next line identified by the channel 12 code. If channel 12 is not loaded in

the EVFU memory, a single line feed will be executed when a VT code is sent.

Channel 15 and 16 – Used as general channel codes or filler channels only when the VFU is accessed by the PI line. In an EVFU form that does not use the PI line, the codes for Channels 15 and 16 function as the Start Load and End Load codes.

End Load – 1F or 6F Hex

The end load code terminates the memory load program. The end load code is 1F hex when the PI line is disabled (low) or 6F hex when the PI line is high. Channel codes in excess of 192 channels received prior to the end load code are discarded.

Using the EVFU

Once the EVFU program has been enabled and loaded, sending the appropriate channel code to the printer will cause any data in the buffer to print and will position the paper to the next line on the form having the specified channel number assigned in EVFU memory.

For a data byte to be recognized as an EVFU instruction, the following criteria must be met:

1. PI line must be enabled and set high; and
2. Data bit 5 must be 0 (not set).

OR:

1. PI line must be disabled or low; and
2. Data bit 5 must be 1 (set).

Given these conditions, the lower four bits of a byte will specify the EVFU channel number. Table 8–1 lists the EVFU channels and their equivalent data bytes with the PI line enabled; Table 8–2 lists the EVFU channel and their equivalent data bytes with the PI line disabled.

Table 8–1. P–Series EVFU Codes – PI Line Enabled

ASCII Hex	ASCII Dec.	Code	Data Bits PI	8	7	6	5	4	3	2	1	Channel
00	0	NUL	1	X	X	X	0	0	0	0	0	1 (TOF)
01	1	SOH	1	X	X	X	0	0	0	0	1	2
02	2	STX	1	X	X	X	0	0	0	1	0	3
03	3	ETX	1	X	X	X	0	0	0	1	1	4
04	4	EOT	1	X	X	X	0	0	1	0	0	5
05	5	ENQ	1	X	X	X	0	0	1	0	1	6
06	6	ACK	1	X	X	X	0	0	1	1	0	7
07	7	BEL	1	X	X	X	0	0	1	1	1	8
08	8	BS	1	X	X	X	0	1	0	0	0	9
09	9	HT	1	X	X	X	0	1	0	0	1	10
0A	10	LF	1	X	X	X	0	1	0	1	0	11
0B	11	VT	1	X	X	X	0	1	0	1	1	12 (VT)
0C	12	FF	1	X	X	X	0	1	1	0	0	13
0D	13	CR	1	X	X	X	0	1	1	0	1	14
0E	14	SO	1	X	0	0	0	1	1	1	0	15
0F	15	SI	1	X	0	0	0	1	1	1	1	16
6E	110	n	1	X	1	1	0	1	1	1	0	Start Load
6F	111	o	1	X	1	1	0	1	1	1	1	End Load
X = Undefined, 0, or 1			1 = High							0 = Low		

Table 8–2. P–Series EVFU Codes – PI Line Disabled or Not Used

ASCII Hex	ASCII Dec.	Code	Data Bits 8	7	6	5	4	3	2	1	Channel
10	16	DLE	0	0	0	1	0	0	0	0	1 (TOF)
11	17	DCI	0	0	0	1	0	0	0	1	2
12	18	DC2	0	0	0	1	0	0	1	0	3
13	19	DC3	0	0	0	1	0	0	1	1	4
14	20	DC4	0	0	0	1	0	1	0	0	5
15	21	NAK	0	0	0	1	0	1	0	1	6
16	22	SYN	0	0	0	1	0	1	1	0	7
17	23	ETB	0	0	0	1	0	1	1	1	8
18	24	CAN	0	0	0	1	1	0	0	0	9
19	25	EM	0	0	0	1	1	0	0	1	10
1A	26	SUB	0	0	0	1	1	0	1	0	11
1B	27	ESC	0	0	0	1	1	0	1	1	12 (VT)
1C	28	FS	0	0	0	1	1	1	0	0	13
1D	29	GS	0	0	0	1	1	1	0	1	14
1E	30	RS	0	0	0	1	1	1	1	0	Start Load
1F	31	US	0	0	0	1	1	1	1	1	End Load
X = Undefined, 0, or 1			1 = High						0 = Low		

NOTE: The ESC code cannot be used simultaneously as the EVFU VT code and the Special Function Control Character (SFCC). If ESC is used as the SFCC, the EVFU must be used with the PI line enabled and set high. Refer to the appropriate protocol chapter for more information on the SFCC.

Clearing the EVFU Memory

The following actions will reset (clear) the EVFU memory:

1. Sending only the start load code.
2. Sending a start load code followed immediately by an end load code.
3. A second start load code is received, resulting in reinitialization of the EVFU. (This allows the host data to be restarted.)

When the EVFU memory is cleared, the forms length returns to the previously set value and the current print position becomes the top–of–form (TOF).

Relative Line Slewing

Another method of moving paper using the PI line results in vertical slews of a specified number of lines within the form relative to the current print line (rather than slewing to a specific line). For this to occur, three criteria must be met:

1. The PI line must be enabled and set high;
2. Data bit 5 must be 1 (set); and
3. The EVFU must be the selected Vertical Format Unit.

The Slew Relative configuration and the status of data bits 1–4 determine the number of lines slewed as described in Table 8–3. (Note that the state of data bit 5 is the difference between line slewing and using the interface lines as EVFU channel codes.) As long as the EVFU is selected, this type of vertical paper motion will occur regardless of whether the EVFU memory is loaded or not.

If the Double High for One Line attribute is active, n+1 lines will be slewed rather than n lines.

Table 8–3. P–Series EVFU Line Slewing

Hex	ASCII Dec.	Code	Data Bits PI	8	7	6	5	4	3	2	1	Lines Slewed
10	16	DLE	1	X	X	X	1	0	0	0	0	1
11	17	DC1	1	X	X	X	1	0	0	0	1	2
12	18	DC2	1	X	X	X	1	0	0	1	0	3
13	19	DC3	1	X	X	X	1	0	0	1	1	4
14	20	DC4	1	X	X	X	1	0	1	0	0	5
15	21	NAK	1	X	X	X	1	0	1	0	1	6
16	22	SYN	1	X	X	X	1	0	1	1	0	7
17	23	ETB	1	X	X	X	1	0	1	1	1	8
18	24	CAN	1	X	X	X	1	1	0	0	0	9
19	25	EM	1	X	X	X	1	1	0	0	1	10
1A	26	SUB	1	X	X	X	1	1	0	1	0	11
1B	27	ESC	1	X	X	X	1	1	0	1	1	12
1C	28	FS	1	X	X	X	1	1	1	0	0	13
1D	29	GS	1	X	X	X	1	1	1	0	1	14
1E	30	RS	1	X	0	0	1	1	1	1	0	15
1F	31	US	1	X	0	0	1	1	1	1	1	16
X = Undefined, 0, or 1			1 = High							0 = Low		

A Migration to the IBM 6400 Printer

Contents

Overview

Most of the information you will need to install and configure an IBM 6400 printer is provided in Chapters 2, 3, and 4 of the *IBM 6400 Line Matrix Printer Setup Guide (P/N S246-0116)*. This appendix provides assistance for the process of configuring the IBM 6400 printer at a site where previous Printronix ASCII line matrix printers are or have been in use. The goal of this appendix is to make your migration from a previous Printronix ASCII printer to the IBM 6400 as simple and trouble free as possible, with the minimum amount of modifications required to your host configuration and application software.

NOTE: Please familiarize yourself with all sections of this Appendix. In the section on "Printer-Specific Migration Information," you need to read only the information describing the Printronix printer models at your site.

Information is provided on migrating from the following Printronix printers to the IBM 6400:

- P4280/P9212-Series ASCII Printers
- P9012 ASCII Printers
- P3000-Series ASCII printers including the P3040 and P3240
- P6000-Series ASCII printers including the P6040, P6080, P6240, and P6280
- MVP-Series printers including the MVP-150, MVP-150B, MVP-L150, and MVP-L150B
- P300/P600-Series Printers

Documentation Related to Migration

The *IBM 6400 Line Matrix Printer Setup Guide (P/N S246-0116)* provides complete unpacking and first-time installation information. In addition, a tutorial on using the configuration menus and detailed information on each part of the configuration menus for the 6400 printer are provided.

If you have the Intelligent Graphics Processor (IGP) or Printronix Graphics Language (PGL) installed on your previous printer, information to help you in migrating from a previous IGP or PGL:to the 6400 IGP/PGL is provided in the *IBM 6400 IGP** User's Manual (P/N S246-0151)*.

If you have the Intelligent Graphics Processor Code V Graphics Language (IGP Code V or VGL) installed on your previous printer, information to help you in migrating from a previous IGP Code V or VGL to the 6400 IGP/VGL is provided in the *IBM 6400 Code V** User's Manual (P/N S246-0150)*.

If you are migrating from a Coax/Twinax printer to the 6400, information to help you in migrating from these platforms is provided in the *IBM 6400 Coax/Twinax Programmer's Reference Manual (P/N S246-0147)*.

Migration Checklist

Before you remove the previous Printronix printer from your site in order to install the IBM 6400, it is important for you to obtain the current configuration of that printer, so that you can replicate it for the 6400. Guidelines and special utility software for that purpose are described in this appendix.

Once you know the configuration of the previous printer, you can use the conversion tables in this appendix to create a configuration for the 6400 that is as close as possible to that of your previous printer.

Information on host interface selection and cabling is also provided.

Additional assistance may be needed in some situations, such as when the previous printer and its configuration information have already been removed before the 6400 is installed. For situations such as these, guidelines for contacting an IBM Customer Service engineer are provided at the end of this appendix.

The migration process is briefly summarized in the following checklist:

1. Determine the configuration of the Printronix printer previously in use at your site, either from a configuration printout, checking your printer's switch settings, or by printing the test file provided (for the P300/P600 only). The method recommended for your printer is described within the topic "Printer-Specific Migration Information."
2. Plan a configuration for the 6400 that is most similar to the previous configuration. Use the equivalence tables provided for each printer type to pinpoint which 6400 menu options correspond to the configuration printout you obtained in Step 1. You may wish to make a xerox copy of the equivalence table for your printer, and note exactly which 6400 menu option values you plan to select.

3. Choose a communications interface and the correct cabling between the 6400 printer and the host system, as described in the section "Selecting a Communications Interface and Cables."

4. Install the IBM 6400 at your site, following the instructions in Chapter Two of the *IBM 6400 Line Matrix Printer Setup Guide.* Configure the 6400 to match the configuration you planned in Step 2. Instructions for using the operator panel and LCD message display to configure the IBM 6400 are provided in Chapters Three and Four of the *Setup Guide.* Save the new 6400 configuration once you have finished modifying it, and define it as the power-on configuration custom set.

5. Troubleshoot problems with your installation if necessary, especially for those situations in which your previous Printronix printer has already been removed from the site before the 6400 is installed. Refer to the "Troubleshooting" section.

6. If you are experiencing difficulty with installation of the IBM 6400 printer in order to replace a previous printer, please contact your authorized IBM service representative for assistance.

Printer-Specific Migration Information

This subsection provides equivalency tables for the configuration of each previous printer that you may have at your site. These tables list a particular configuration menu option for the previous printer, and provide the equivalent menu option for the IBM 6400. The complete set of menus and the values you may select for each menu option are described in detail in Chapter 4 of the *IBM 6400 Line Matrix Printer Setup Guide (P/N S246-0116)*, and in the *Setup Guide* or *User Manual* for your previous printer.

NOTE: The operator panels and configuration menus for Printronix printers have been revised periodically to add new features and functionality. Your particular printer may vary slightly from what is shown.

The equivalency tables for each migration section are divided into two columns. The lefthand column of each table shows the menu options that were provided with a previous printer. The righthand column lists the equivalent option that is provided with the IBM 6400 ASCII printer, and the path through the menus to reach that option. Where several menu items are shown at the same level of indent in the righthand column, this indicates that any of these items is a possible path to the menu option.

A sample row from an equivalency table is shown below.

P4280 / P9212 Menu Option	IBM 6400 Menu Option
Auto Line Feed	Emulation Configuration Printer Emulation Configuration Proprinter III XL Emulation Epson Emulation P-Series Emulation P-Series XQ Emulation Serial Matrix Emulation **Auto LF**

In the example shown above, the ASCII P4280/P9212 menu option for selecting Auto Line Feed is shown in the lefthand column. In the righthand column, the equivalent menu option for the IBM 6400 printer, Auto LF, is shown. The path through the IBM 6400 menus to reach the Auto LF option traverses from the main menu item *Emulation Configuration* to *Printer Emulation Configuration* through any of the ASCII emulations to Auto LF. The IBM 6400 main configuration menu is shown in Figure A–1. The Printer Emulation Configuration menu is shown in Figure A–2.

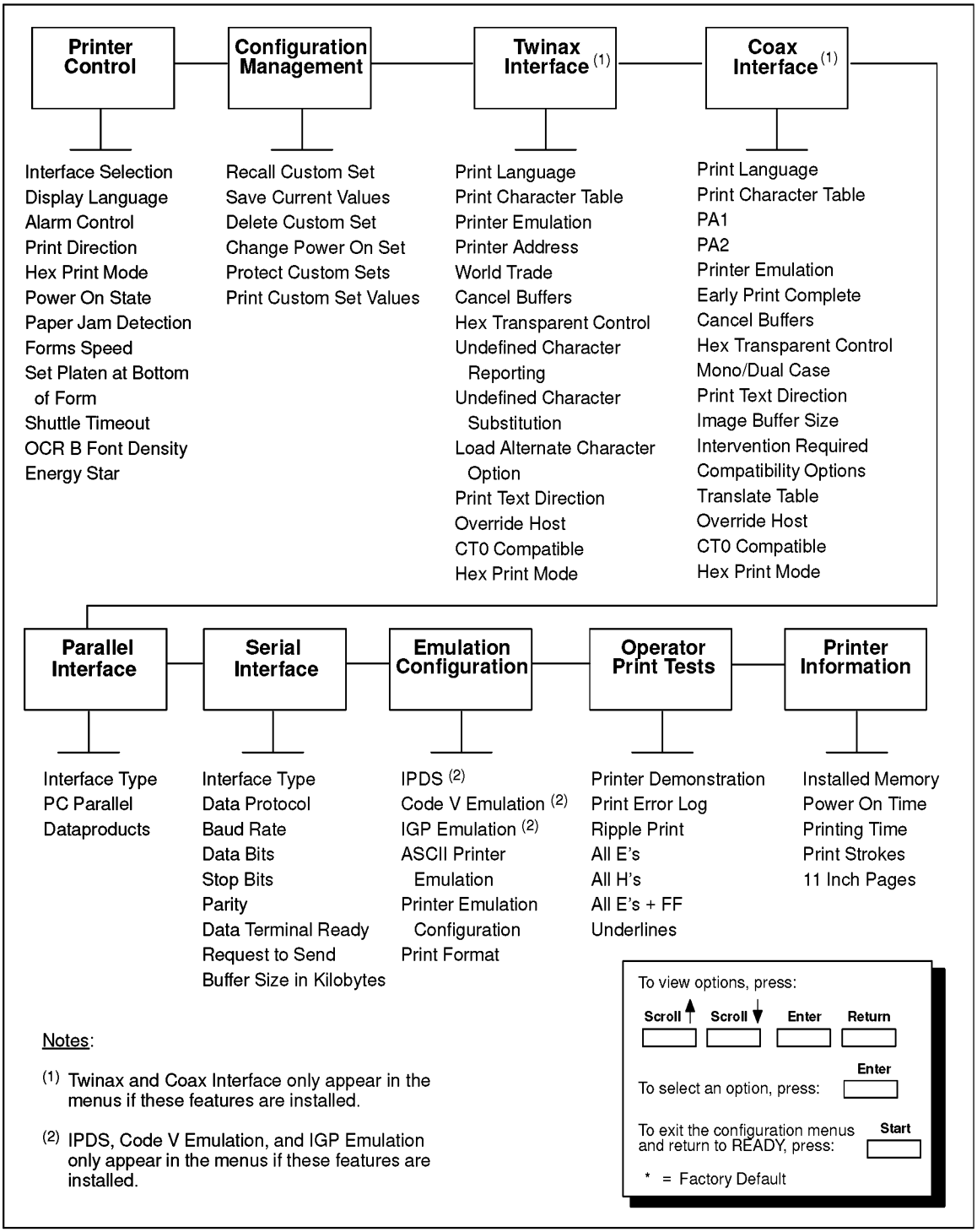


Figure A–1. The Configuration Main Menu

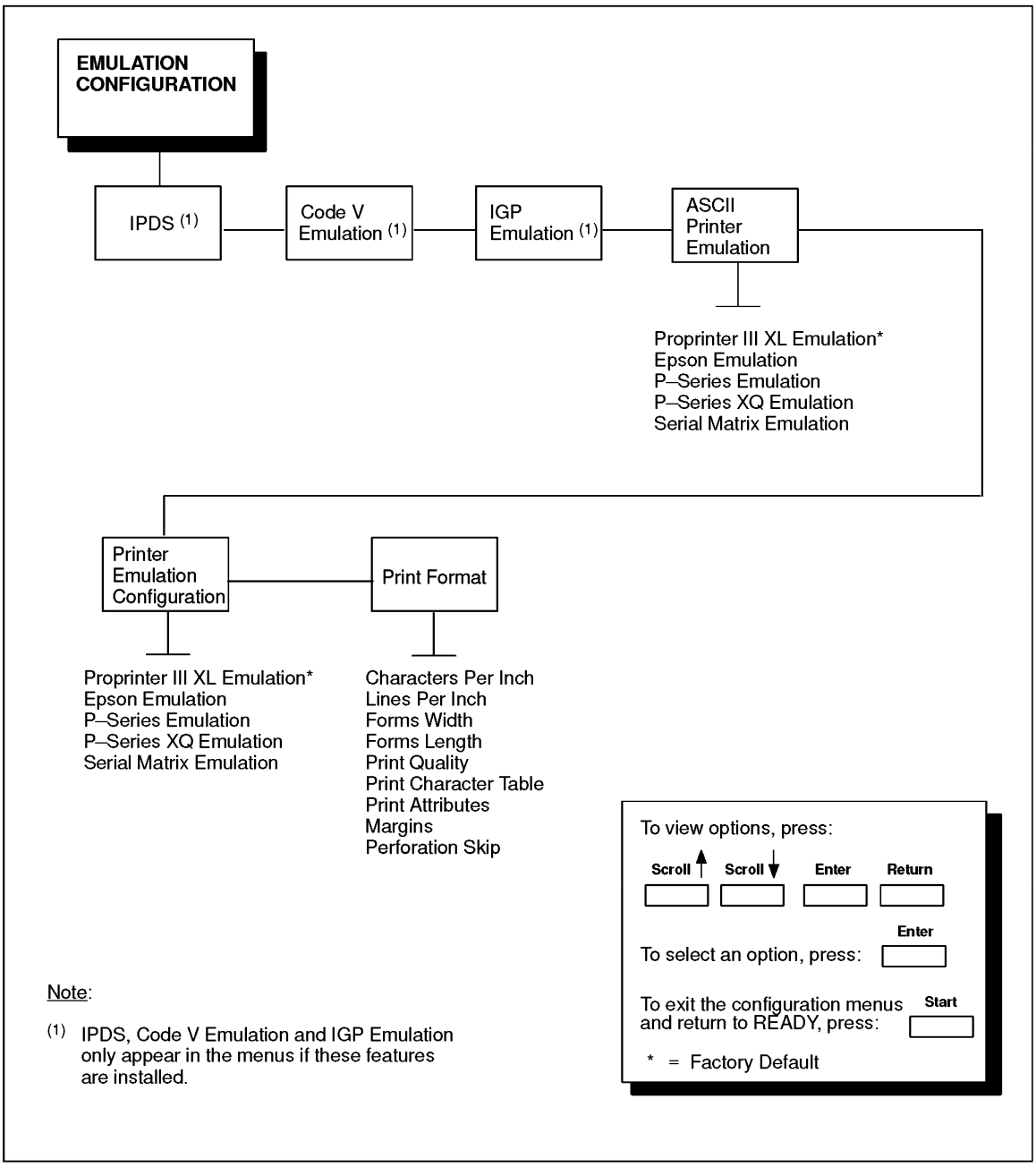


Figure A–2. Emulation Configuration Menu

The complete set of configuration menus referenced in the equivalency tables is provided in Chapter 4 of the *IBM 6400 Line Matrix Printer Setup Guide (P/N S246-0116).*

Migrating from P4280 and P9212 ASCII Printers

The Printronix P4280 and P9212 ASCII printers provide a configuration menu option that generates a configuration printout of the current configuration. You may have a current configuration printout stored with the printer. If not, the *Setup Guide* or *User Manual* for your printer provides a procedure for printing the current printer configuration as well as the factory default configuration.

Table A–1 lists P4280 and P9212 ASCII menu options and provides the corresponding menu options for the IBM 6400. You may wish to make a xerox copy of this table, and pencil in the option values from your previous printer's configuration printout. Then you can configure equivalent option values for the 6400 once it is installed and ready to be configured.

Table A–1. P4280/P9212 to 6400 Conversion Table

P4280 / P9212 Menu Option	IBM 6400 Menu Option
RIBBON LIFE	
Job Rate	N/A
Ribbon Size	N/A
When Worn Action	N/A
Enable/Disable	N/A
FONT	
Font	Emulation Configuration Print Format Print Quality
CHARACTER SET	
Select Set	Emulation Configuration Printer Emulation Configuration P-Series / Serial Matrix Emulation Character Sets
Select Subset	Emulation Configuration Printer Emulation Configuration P-Series / Serial Matrix Emulation Print Language Select Subset Primary Select Subset Extended
Select Language	Emulation Configuration Printer Emulation Configuration P-Series / Serial Matrix Emulation Print Language Multinational
	continued next page

Table A–1. P4280/P9212 to 6400 Conversion Table *(continued)*

P4280 / P9212 Menu Option	IBM 6400 Menu Option
APPLICATION COMPATIBILITY	
Printer Protocol	Emulation Configuration ASCII Printer Emulation
Buffer Size	N/A
Uppercase Select	Emulation Configuration Printer Emulation Configuration P-Series XQ Emulation Upper Case Select
Printer Select	Emulation Configuration Printer Emulation Configuration Epson Emulation Serial Matrix Emulation Printer Select
Paper Advance Switch	N/A
Power On State	Printer Control Power On State
Alarm On Fault	Printer Control Alarm Control
Shuttle Timeout	Printer Control Shuttle Timeout
Unidirectional	Printer Control Print Direction
Select SFCC	Emulation Configuration Printer Emulation Configuration P-Series Emulation Select SFCC
80-9F Hex	Emulation Configuration Printer Emulation Configuration P-Series / Serial Matrix Emulation Alternate Set 80-9F
	continued next page

Table A–1. P4280/P9212 to 6400 Conversion Table *(continued)*

P4280 / P9212 Menu Option	IBM 6400 Menu Option
APPLICATION COMPATIBILITY *(continued)*	
Control Code 06	Emulation Configuration Printer Emulation Configuration P-Series Emulation P-Series XQ Emulation Serial Matrix Emulation Control Code 06
Control Code 08	Emulation Configuration Printer Emulation Configuration P-Series Emulation Control Code 08
Overstrike	Emulation Configuration Printer Emulation Configuration P-Series / Serial Matrix Emulation Overstrike
Compress Print	Emulation Configuration Printer Emulation Configuration P-Series XQ Emulation Compressed Print
Draft Print	Emulation Configuration Printer Emulation Configuration P-Series XQ Emulation High Speed Print Mode
Font Select / Elongated	Emulation Configuration Printer Emulation Configuration P-Series XQ Emulation Elong / Alt. Font
View	N/A
Display Language	Printer Control Display Language
	continued next page

Table A–1. P4280/P9212 to 6400 Conversion Table *(continued)*

P4280 / P9212 Menu Option	IBM 6400 Menu Option
PAPER FORMAT	
Line Spacing	Emulation Configuration Print Format Lines Per Inch
Form Length Set	Emulation Configuration Print Format Forms Length
Auto Line Feed	Emulation Configuration Printer Emulation Configuration Proprinter III XL Emulation Epson Emulation P-Series Emulation P-Series XQ Emulation Serial Matrix Emulation Auto LF
Define CR Code	Emulation Configuration Printer Emulation Configuration Proprinter III XL Emulation Epson Emulation P-Series Emulation P-Series XQ Emulation Serial Matrix Emulation Define CR Code
Define LF Code	Emulation Configuration Printer Emulation Configuration Proprinter III XL Emulation Epson Emulation P-Series Emulation P-Series XQ Emulation Serial Matrix Emulation Define LF Code
	continued next page

Table A–1. P4280/P9212 to 6400 Conversion Table *(continued)*

P4280 / P9212 Menu Option	IBM 6400 Menu Option
PAPER FORMAT (continued)	
VFU Select	Emulation Configuration Printer Emulation Configuration P-Series Emulation P-Series XQ Emulation EVFU Selected
Perforation Skip	Emulation Configuration Print Format Perforation Skip
Paper Out	N/A
Paperout Adjust	See the *IBM 6400 Series Maintenance Information Manual* for instructions on setting the "End of Forms Adjust" value.
PMD Fault	Printer Control Paper Jam Detection
Slew Relative	Emulation Configuration Printer Emulation Configuration P-Series XQ Emulation Slew Relative
Print Width	Emulation Configuration Print Format Forms Width
HOST INTERFACE - Parallel	
	Printer Control Interface Selection Parallel Interface Interface Type
Data Bit 8	Parallel Interface PC Parallel / Dataproducts Data Bit 8
PI Line	Parallel Interface Dataproducts PI Ignored

continued next page

Table A–1. P4280/P9212 to 6400 Conversion Table *(continued)*

P4280 / P9212 Menu Option	IBM 6400 Menu Option
HOST INTERFACE - Parallel (continued)	
Data Polarity	Parallel Interface PC Parallel / Dataproducts Data Polarity
Resp. Polarity	Parallel Interface PC Parallel Response Polarity Dataproducts Data Request Polarity
Fast Busy	Parallel Interface PC Parallel Busy On Strobe
Strobe Polarity	Parallel Interface PC Parallel / Dataproducts Strobe Polarity
Latch Data On	Parallel Interface PC Parallel Latch Data On
HOST INTERFACE - Serial	
	Printer Control Interface Selection Serial Interface Interface Type
Data Protocol	Serial Interface Data Protocol
Data Rate	Serial Interface Baud Rate
Word Length	Serial Interface Data Bits
	continued next page

Table A–1. P4280/P9212 to 6400 Conversion Table *(continued)*

P4280 / P9212 Menu Option	IBM 6400 Menu Option
HOST INTERFACE - Serial (continued)	
Stop Bit	Serial Interface Stop Bits
Parity	Serial Interface Parity
Bit 8 Function	N/A
Data Term Ready	Serial Interface Data Terminal Ready
Request To Send	Serial Interface Request To Send
Reverse Channel	N/A

Migrating from P9012 ASCII Printers

The Printronix P9012 ASCII printers provide a configuration menu option on the Diagnostics menu that generates a configuration printout of the current configuration. You may have a current configuration printout stored with the printer. If not, the *User Manual* for your printer provides a procedure for printing the current printer configuration as well as the factory default configuration.

Table A–2 lists P9012 ASCII menu options, and provides the corresponding menu options for the IBM 6400. You may wish to make a xerox copy of this table, and pencil in the option values from your previous printer's configuration printout. Then you can configure equivalent option values for the 6400 once it is installed and ready to be configured.

Table A–2. P9012 to 6400 Conversion Table

P9012 Menu Option	IBM 6400 Menu Option
PRINT STATISTICS	
Power On Time	N/A
Print Time	N/A
Shuttle Strokes	N/A
Print Lines	N/A
Print Pages	N/A
CONFIGURATION	
Form Length Set	Emulation Configuration Print Format Forms Length
Line Spacing	Emulation Configuration Print Format Lines Per Inch
Print Mode	Emulation Configuration Print Format Print Quality
RIBBON LIFE	
Job Rate	N/A
Ribbon Size	N/A

continued next page

Table A–2. P9012 to 6400 Conversion Table *(continued)*

P9012 Menu Option	IBM 6400 Menu Option
RIBBON LIFE (continued)	
When Worn Action	N/A
Enable / Disable	N/A
CHARACTER SET	
Select Set	Emulation Configuration Printer Emulation Configuration P-Series / Serial Matrix Emulation Character Sets
Select Subset	Emulation Configuration Printer Emulation Configuration P-Series / Serial Matrix Emulation Print Language Select Subset Primary Select Subset Extended
Select Language	Emulation Configuration Printer Emulation Configuration P-Series / Serial Matrix Emulation Print Language Multinational
APPLICATION COMPATIBILITY	
Printer Protocol	Emulation Configuration ASCII Printer Emulation
Buffer Size	Parallel Interface PC Parallel Buffer Size in Kilobytes Serial Interface Buffer Size in Kilobytes
Power On State	Printer Control Power On State

continued next page

Table A–2. P9012 to 6400 Conversion Table *(continued)*

P9012 Menu Option	IBM 6400 Menu Option
APPLICATION COMPATIBILITY (continued)	
Alarm On Fault	Printer Control Alarm Control
Shuttle Timeout	Printer Control Shuttle Timeout
Unidirectional	Printer Control Print Direction
Select SFCC	Emulation Configuration Printer Emulation Configuration P-Series Emulation Select SFCC
80-9F Hex	Emulation Configuration Printer Emulation Configuration P-Series / Serial Matrix Emulation Alternate Set 80-9F
Control Code 06	Emulation Configuration Printer Emulation Configuration P-Series Emulation P-Series XQ Emulation Serial Matrix Emulation Control Code 06
Control Code 08	Emulation Configuration Printer Emulation Configuration P-Series Emulation Control Code 08
Overstrike	Emulation Configuration Printer Emulation Configuration P-Series / Serial Matrix Emulation Overstrike
Display Language	Printer Control Display Language
	continued next page

Table A–2. P9012 to 6400 Conversion Table *(continued)*

P9012 Menu Option	IBM 6400 Menu Option
PAPER FORMAT	
Auto Line Feed	Emulation Configuration Printer Emulation Configuration Proprinter III XL Emulation Epson Emulation P-Series Emulation P-Series XQ Emulation Serial Matrix Emulation Auto LF
Define CR Code	Emulation Configuration Printer Emulation Configuration Proprinter III XL Emulation Epson Emulation P-Series Emulation P-Series XQ Emulation Serial Matrix Emulation Define CR Code
VFU Select	Emulation Configuration Printer Emulation Configuration P-Series Emulation P-Series XQ Emulation EVFU Selected
Perforation Skip	Emulation Configuration Print Format Perforation Skip
Paper Out	N/A
PMD Fault	Printer Control Paper Jam Detection
Print Width	Emulation Configuration Print Format Forms Width
	continued next page

Table A–2. P9012 to 6400 Conversion Table *(continued)*

P9012 Menu Option	IBM 6400 Menu Option
HOST INTERFACE - Parallel	
	Printer Control Interface Selection Parallel Interface Interface Type
Data Bit 8	Parallel Interface PC Parallel / Dataproducts Data Bit 8
PI Line	Parallel Interface Dataproducts PI Ignored
Data Polarity	Parallel Interface PC Parallel / Dataproducts Data Polarity
Resp. Polarity	Parallel Interface PC Parallel Response Polarity Dataproducts Data Request Polarity
Fast Busy	Parallel Interface PC Parallel Busy On Strobe
Strobe Polarity	Parallel Interface PC Parallel / Dataproducts Strobe Polarity
Latch Data On	Parallel Interface PC Parallel Latch Data On
	continued next page

Table A–2. P9012 to 6400 Conversion Table *(continued)*

P9012 Menu Option	IBM 6400 Menu Option
HOST INTERFACE - Serial	
	Printer Control Interface Selection Serial Interface Interface Type
Data Protocol	Serial Interface Data Protocol
Data Rate	Serial Interface Baud Rate
Word Length	Serial Interface Data Bits
Stop Bit	Serial Interface Stop Bits
Parity	Serial Interface Parity
Bit 8 Function	N/A
CD and DSR	N/A
CTS and DSR	N/A
Data Term Ready	Serial Interface Data Terminal Ready
Request To Send	Serial Interface Request To Send
Reverse Channel	N/A

Migrating from P3000 ASCII Printers

The Printronix P3000-Series ASCII printers (including the P3040 and P3240) provide an option on the Diagnostics menu that generates a configuration printout of the current configuration. You may have a current configuration printout stored with the printer. If not, the *User Manual* for your printer provides a procedure for printing the current (or default) printer configuration.

Table A–3 lists the P3000 ASCII menu options, and provides the corresponding menu options for the IBM 6400. You may wish to make a xerox copy of this table, and pencil in the option values from your P3000 printer's configuration printout. Then you can configure equivalent option values for the 6400 once it is installed and ready to be configured.

Table A–3. P3000 to 6400 Conversion Table

P3000 Menu Option	IBM 6400 Menu Option
Forms Length Set	Emulation Configuration Print Format Forms Length
Line Spacing	Emulation Configuration Print Format Lines Per Inch
Print Mode	Emulation Configuration Print Format Print Quality
Select Set	Emulation Configuration Printer Emulation Configuration P-Series / Serial Matrix Emulation Character Sets
Select Subset	Emulation Configuration Printer Emulation Configuration P-Series / Serial Matrix Emulation Print Language Select Subset Primary Select Subset Extended
	continued next page

Table A–3. P3000 to 6400 Conversion Table *(continued)*

P3000 Menu Option	IBM 6400 Menu Option
Select Language	Emulation Configuration Printer Emulation Configuration P-Series / Serial Matrix Emulation Print Language
APPLICATION COMPATIBILITY	
Printer Protocol	Emulation Configuration ASCII Printer Emulation
Printer Select	Emulation Configuration Printer Emulation Configuration Epson Emulation Serial Matrix Emulation Printer Select
Paper Advance Switch	N/A
Power On State	Printer Control Power On State
Alarm On Fault	Printer Control Alarm Control
Unidirectional	Printer Control Print Direction
Select SFCC	Emulation Configuration Printer Emulation Configuration P-Series Emulation Select SFCC
80-9F Hex	Emulation Configuration Printer Emulation Configuration P-Series / Serial Matrix Emulation Alternate Set 80-9F
Control Code 08	Emulation Configuration Printer Emulation Configuration P-Series Emulation Control Code 08
	continued next page

Table A–3. P3000 to 6400 Conversion Table *(continued)*

P3000 Menu Option	IBM 6400 Menu Option
APPLICATION COMPATIBILITY (continued)	
Overstrike	Emulation Configuration Printer Emulation Configuration P-Series / Serial Matrix Emulation Overstrike
Control Code 06	Emulation Configuration Printer Emulation Configuration P-Series Emulation P-Series XQ Emulation Serial Matrix Emulation Control Code 06
PAPER FORMAT	
Auto Line Feed	Emulation Configuration Printer Emulation Configuration Proprinter III XL Emulation Epson Emulation P-Series Emulation P-Series XQ Emulation Serial Matrix Emulation Auto LF
Define CR Code	Emulation Configuration Printer Emulation Configuration Proprinter III XL Emulation Epson Emulation P-Series Emulation P-Series XQ Emulation Serial Matrix Emulation Define CR Code
	continued next page

Table A–3. P3000 to 6400 Conversion Table *(continued)*

P3000 Menu Option	IBM 6400 Menu Option
PAPER FORMAT (continued)	
Define LF Code	Emulation Configuration Printer Emulation Configuration Proprinter III XL Emulation Epson Emulation P-Series Emulation P-Series XQ Emulation Serial Matrix Emulation Define LF Code
VFU Select	Emulation Configuration Printer Emulation Configuration P-Series Emulation P-Series XQ Emulation EVFU Selected
Perforation Skip	Emulation Configuration Print Format Perforation Skip
Paper Out	N/A
PMD Fault	Printer Control Paper Jam Detection
Print Width	Emulation Configuration Print Format Forms Width
HOST INTERFACE - Parallel	
	Printer Control Interface Selection Parallel Interface Interface Type
Data Bit 8	Parallel Interface PC Parallel / Dataproducts Data Bit 8

continued next page

Table A–3. P3000 to 6400 Conversion Table *(continued)*

P3000 Menu Option	IBM 6400 Menu Option
HOST INTERFACE - Parallel (continued)	
Data Polarity	Parallel Interface PC Parallel / Dataproducts Data Polarity
Resp Polarity	Parallel Interface PC Parallel Response Polarity Dataproducts Data Request Polarity
PI Line	Parallel Interface Dataproducts PI Ignored
Strobe Polarity	Parallel Interface PC Parallel / Dataproducts Strobe Polarity
Latch Data On	Parallel Interface PC Parallel Latch Data On
HOST INTERFACE - Serial	
	Printer Control Interface Selection Serial Interface Interface Type
Data Protocol	Serial Interface Data Protocol
Data Rate	Serial Interface Baud Rate
Word Length	Serial Interface Data Bits
Stop Bit	Serial Interface Stop Bits
	continued next page

Table A–3. P3000 to 6400 Conversion Table *(continued)*

P3000 Menu Option	IBM 6400 Menu Option
HOST INTERFACE - Serial (continued)	
Parity	Serial Interface Parity
Bit 8 Function	N/A
CD and CTS	N/A
DSR	N/A
Data Term Ready	Serial Interface Data Terminal Ready
Request To Send	Serial Interface Request To Send
Reverse Channel	N/A

Migrating from P6000 ASCII Printers

The Printronix P6000-Series ASCII printers (including the P6040, P6080, P6240, and P6280) provide an option on the Diagnostics menu for generating a configuration printout. You may have a current configuration printout stored with the printer. If not, the printer's *User Manual* provides a procedure for printing the current (or factory default) configuration.

Table A–4 lists only the P6x40 and 6x80 Level One Firmware menu options, and provides corresponding options for the IBM 6400. Table A–5 lists P6x40, and P6x80 ASCII Level 2 Firmware menu options, and provides the corresponding menu options for the IBM 6400. You may wish to make a xerox copy of the table for your printer, and pencil in the option values from your configuration printout. Then you can configure equivalent option values for the 6400 once it is installed and ready to be configured.

Table A–4. P6x40/P6x80 (Level One Firmware) to 6400 Conversion Table

P6x40/6x80 Level One Menu Option	IBM 6400 Menu Option
APPLICATION PARAMETERS	
Forms Length Set	Emulation Configuration Print Format Forms Length
Print Mode	Emulation Configuration Print Format Print Quality
Line Spacing	Emulation Configuration Print Format Lines Per Inch
Character Set	Emulation Configuration Printer Emulation Configuration P-Series / Serial Matrix Emulation Character Sets
	continued next page

Table A–4. P6x40/P6x80 (Level One Firmware) to 6400 Conversion Table *(continued)*

P6x40/6x80 Level One Menu Option	IBM 6400 Menu Option
APPLICATION PARAMETERS (continued)	
Auto Line Feed	Emulation Configuration Printer Emulation Configuration Proprinter III XL Emulation Epson Emulation P-Series Emulation P-Series XQ Emulation Serial Matrix Emulation Auto LF
No Paper Motion	Emulation Configuration Printer Emulation Configuration Proprinter III XL Emulation Epson Emulation P-Series Emulation P-Series XQ Emulation Serial Matrix Emulation Define CR Code
Linefeed / Newline	Emulation Configuration Printer Emulation Configuration Proprinter III XL Emulation Epson Emulation P-Series Emulation P-Series XQ Emulation Serial Matrix Emulation Define LF Code
Uppercase	Emulation Configuration Printer Emulation Configuration P-Series XQ Emulation Upper Case Select
	continued next page

Table A–4. P6x40/P6x80 (Level One Firmware) to 6400 Conversion Table *(continued)*

P6x40/6x80 Level One Menu Option	IBM 6400 Menu Option
APPLICATION PARAMETERS (continued)	
VFU Select	Emulation Configuration Printer Emulation Configuration P-Series Emulation P-Series XQ Emulation EVFU Selected
Paper Motion	Printer Control Paper Jam Detection
Power-Up	Printer Control Power On State
Underline	N/A
Mod Plot	N/A
Perforation Skip	Emulation Configuration Print Format Perforation Skip
Paper Fault	N/A
INTERFACE PARAMETERS	
Printer	Emulation Configuration ASCII Printer Emulation
Special Function	Emulation Configuration Printer Emulation Configuration P-Series Emulation Select SFCC
Data Line 8	Parallel Interface PC Parallel / Dataproducts Data Bit 8
PI Line	Parallel Interface Dataproducts PI Ignored

continued next page

Table A–4. P6x40/P6x80 (Level One Firmware) to 6400 Conversion Table *(continued)*

P6x40/6x80 Level One Menu Option	IBM 6400 Menu Option
INTERFACE PARAMETERS (continued)	
Fast Busy	Parallel Interface PC Parallel Busy On Strobe
Buffer Size	Parallel Interface PC Parallel Buffer Size in Kilobytes Serial Interface Buffer Size in Kilobytes
Parallel	Printer Control Interface Selection Parallel Interface Interface Type
PARALLEL INTERFACE HARDWARE JUMPER CONFIGURATION	
E14-E15 Dataproducts Strobe Polarity	Parallel Interface Dataproducts Strobe Polarity
E49-E50 Data Latch Edge Select E50-E51 Data Latch Edge Select E52-E53 ACK Edge Select	Parallel Interface PC Parallel Latch Data On
HOST INTERFACE - Serial	
Data Protocol	Serial Interface Data Protocol
Data Rate	Serial Interface Baud Rate
Word Length	Serial Interface Data Bits Parity
Request To Send	Serial Interface Request To Send
Reverse Channel	N/A

continued next page

Table A–4. P6x40/P6x80 (Level One Firmware) to 6400 Conversion Table *(continued)*

P6x40/6x80 Level One Menu Option	IBM 6400 Menu Option
HOST INTERFACE - Serial (continued)	
Data Term Ready	Serial Interface Data Terminal Ready
Stop Bit	Serial Interface Stop Bits
XON or ACK Character Assignment	N/A
XOFF or NAK Character Assignment	N/A
Serial	Printer Control Interface Selection Serial Interface Interface Type

Table A–5. P6x40/P6x80 (Level Two Firmware) to 6400 Conversion Table

P6x40/6x80 Level Two Menu Option	IBM 6400 Menu Option
Forms Length Set	Emulation Configuration Print Format Forms Length
Line Spacing	Emulation Configuration Print Format Lines Per Inch
Print Mode	Emulation Configuration Print Format Print Quality
Character Set	Emulation Configuration Printer Emulation Configuration P-Series / Serial Matrix Emulation Character Sets
RIBBON LIFE	
Ribbon Size	N/A
Job Rate	N/A
When Worn Action	N/A
Enable/Disable	N/A
PRINT STATISTICS	
Power On Time	N/A
Print Time	N/A
Shuttle Strokes	N/A
Print Lines	N/A
Print Pages	N/A
APPLICATION COMPATIBILITY	
Printer Protocol	Emulation Configuration ASCII Printer Emulation
Buffer Size	N/A
Uppercase Select	Emulation Configuration Printer Emulation Configuration P-Series XQ Emulation Upper Case Select

continued next page

Table A–5. P6x40/P6x80 (Level Two Firmware) to 6400 Conversion Table *(continued)*

P6x40/6x80 Level Two Menu Option	IBM 6400 Menu Option
APPLICATION COMPATIBILITY (continued)	
Printer Select	Emulation Configuration Printer Emulation Configuration Epson Emulation Serial Matrix Emulation Printer Select
Paper Advance Switch	N/A
Power On State	Printer Control Power On State
Unidirectional	Printer Control Print Direction
PAPER FORMAT	
Auto Line Feed	Emulation Configuration Printer Emulation Configuration Proprinter III XL Emulation Epson Emulation P-Series Emulation P-Series XQ Emulation Serial Matrix Emulation Auto LF
Define CR Code	Emulation Configuration Printer Emulation Configuration Proprinter III XL Emulation Epson Emulation P-Series Emulation P-Series XQ Emulation Serial Matrix Emulation Define CR Code
	continued next page

Table A–5. P6x40/P6x80 (Level Two Firmware) to 6400 Conversion Table *(continued)*

P6x40/6x80 Level Two Menu Option	IBM 6400 Menu Option
PAPER FORMAT (continued)	
Define LF Code	Emulation Configuration Printer Emulation Configuration Proprinter III XL Emulation Epson Emulation P-Series Emulation P-Series XQ Emulation Serial Matrix Emulation Define LF Code
VFU Select	Emulation Configuration Printer Emulation Configuration P-Series Emulation P-Series XQ Emulation EVFU Selected
Perforation Skip	Emulation Configuration Print Format Perforation Skip
PMD Fault	Printer Control Paper Jam Detection
Modified Plot	N/A
Slew Relative	Emulation Configuration Printer Emulation Configuration P-Series XQ Emulation Slew Relative
HOST INTERFACE - Parallel	
	Printer Control Interface Selection Parallel Interface Interface Type

continued next page

Table A–5. P6x40/P6x80 (Level Two Firmware) to 6400 Conversion Table *(continued)*

P6x40/6x80 Level Two Menu Option	IBM 6400 Menu Option
HOST INTERFACE - Parallel (continued)	
Data Bit 8	Parallel Interface PC Parallel / Dataproducts Data Bit 8
Data Polarity	Parallel Interface PC Parallel / Dataproducts Data Polarity
Resp. Polarity	Parallel Interface PC Parallel Response Polarity Dataproducts Data Request Polarity
Fast Busy	Parallel Interface PC Parallel Busy On Strobe
PI Line	Parallel Interface Dataproducts PI Ignored
HOST INTERFACE - Serial	
	Printer Control Interface Selection Serial Interface Interface Type
Data Protocol	Serial Interface Data Protocol
Data Rate	Serial Interface Baud Rate
Word Length	Serial Interface Data Bits
Stop Bit	Serial Interface Stop Bits

continued next page

Table A–5. P6x40/P6x80 (Level Two Firmware) to 6400 Conversion Table *(continued)*

P6x40/6x80 Level Two Menu Option	IBM 6400 Menu Option
HOST INTERFACE - Serial (continued)	
Parity	Serial Interface Parity
Bit 8 Function	N/A
CD and DSR	N/A
CTS and DSR	N/A
Data Term Ready	Serial Interface Data Terminal Ready
Request To Send	Serial Interface Request To Send
Reverse Channel	N/A

Migrating from MVP-Series ASCII Printers

The Printronix MVP-Series ASCII printers (including the MVP-150, MVP-150B, MVP-L150, and MVP-L150B) provide the configuration self-test 00.1, which prints the configuration settings of Configuration Options 20 through 99 and the part number of each PROM installed. You may have a current configuration printout stored with the printer. If not, the printer's *User Manual* provides a procedure for printing the current (or factory default) configuration.

Table A–6 lists MVP-150/MVP-L150 codes 20-99, the configuration option represented by each code, and the corresponding menu options for the IBM 6400. Table A–7 lists MVP-150B/MVP-L150B codes 20-99, the configuration option represented by each code, and the corresponding menu options for the IBM 6400. You may wish to make a xerox copy of one of these tables, and fill in the option values from your previous printer's configuration printout. This will help you to configure equivalent option values for the 6400 once it is installed and ready to be configured.

Table A–6. MVP-150/MVP-L150 to 6400 Conversion Table

MVP-150/MVP-L150 Menu Option	IBM 6400 Menu Option
20.x-Host Mode Control	Emulation Configuration ASCII Printer Emulation
21.x-Vertical Dot Density	N/A
22.x-Insert Auto L/F After Max Character Position	Emulation Configuration Printer Emulation Configuration Proprinter III XL Emulation Epson Emulation P-Series Emulation P-Series XQ Emulation Serial Matrix Emulation Auto LF
	continued on next page

Table A–6. MVP-150/MVP-L150 to 6400 Conversion Table *(continued)*

MVP-150/MVP-L150 Menu Option	IBM 6400 Menu Option
23.x-Auto L/F On C/R	Emulation Configuration Printer Emulation Configuration Proprinter III XL Emulation Epson Emulation P-Series Emulation P-Series XQ Emulation Serial Matrix Emulation Define CR Code
24.x-Inhibit Underlines &	N/A
Uppercase Printing	Emulation Configuration Printer Emulation Configuration P-Series XQ Emulation Upper Case Select
25.x-PI Line Paper Slew Using Binary Count	Emulation Configuration Printer Emulation Configuration P-Series XQ Emulation Slew Relative
26.x-On-line Condition At Power Up	Printer Control Power On State
27.x-Paper Out Delay	N/A
28.x-Enable Underline	N/A
29.x-Delete Character Option	N/A
30.x-Print or Graphics Mode At Power On	Emulation Configuration Print Format Print Quality
	continued on next page

Table A–6. MVP-150/MVP-L150 to 6400 Conversion Table *(continued)*

MVP-150/MVP-L150 Menu Option	IBM 6400 Menu Option
31.x Thru 41.x Control Codes	Emulation Configuration Printer Emulation Configuration P-Series Emulation Control Code 06 Control Code 08 Select SFCC P-Series XQ Emulation Control Code 06 Elong/Alt. Font Serial Matrix Emulation Control Code 06
42.x-EVFU Control	Emulation Configuration Printer Emulation Configuration P-Series Emulation EVFU Selected
43.x-Plotting Exit	N/A
44.x-Print Buffer With TOF Switch	N/A
45.x Thru 49.x Are Not Used	N/A
50.x-Page Perforation Skip	Emulation Configuration Print Format Perforation Skip
51.x-Lines Per Inch	Emulation Configuration Print Format Lines Per Inch
52.x-Forms Length At Power Up	Emulation Configuration Print Format Forms Length
53.x Thru 59.x Are Not Used	N/A
60.x-Data Line 8	Parallel Interface PC Parallel / Dataproducts Data Bit 8

continued on next page

Table A–6. MVP-150/MVP-L150 to 6400 Conversion Table *(continued)*

MVP-150/MVP-L150 Menu Option	IBM 6400 Menu Option
61.x-PI Line	Parallel Interface Dataproducts PI Ignored
62.x-Data Strobe Polarity	Parallel Interface PC Parallel / Dataproducts Strobe Polarity
63.x-Data / Response Line Polarity	Parallel Interface PC Parallel Data Polarity Response Polarity Dataproducts Data Polarity Data Request Polarity
64.x-Not Used	N/A
65.x-Busy Line Handling	Parallel Interface PC Parallel Busy On Strobe
66.x-Interface Select	Printer Control Interface Selection Parallel Interface Interface Type
67.x Thru 69.x Are Not Used	N/A
70.x-Serial Interface/ Protocol Selection	Serial Interface Interface Type Data Protocol
71.x-Serial Data Transfer And Baud Rate	Serial Interface Baud Rate Stop Bits

continued on next page

Table A–6. MVP-150/MVP-L150 to 6400 Conversion Table *(continued)*

MVP-150/MVP-L150 Menu Option	IBM 6400 Menu Option
72.x-Data Word Description	Serial Interface Data Bits Parity
73.x-Data Polarity	N/A
74.x-Request To Send (RTS)	Serial Interface Request To Send
75.x-Clear To Send (CTS) And Carrier Detect (CD) Protocol	N/A
76.x-Data Set Ready (DSR)	N/A
77.x-Reverse Channel Control (RC)	N/A
78.x-Data Terminal Ready (DTR)	Serial Interface Data Terminal Ready
79.x-XON Buffer Almost Empty Threshold	N/A
80.x-XOFF Buffer Almost Full Threshold	N/A
81.x-Current Loop Source	N/A
82.x-XON or ACK Character Assignment	N/A
83.x-XOFF or NAK Character Assignment	N/A
84.x-ETX Character Assignment	N/A
85.x Thru 99.x Are Not Used	N/A

Table A–7. MVP-150B/MVP-L150B to 6400 Conversion Table

MVP-150B/MVP-L150B Menu Option	IBM 6400 Menu Option
20.x-Expanded Print (Double Wide)	N/A
21.x-Vertical Dot Density	N/A
22.x-Insert Auto L/F After Max Character Position	Emulation Configuration Printer Emulation Configuration Proprinter III XL Emulation Epson Emulation P-Series Emulation P-Series XQ Emulation Serial Matrix Emulation Auto LF
23.x-Auto L/F On C/R	Emulation Configuration Printer Emulation Configuration Proprinter III XL Emulation Epson Emulation P-Series Emulation P-Series XQ Emulation Serial Matrix Emulation Define CR Code
24.x-Inhibit Underlines & Lowercase	N/A
Uppercase Printing	Emulation Configuration Printer Emulation Configuration P-Series XQ Emulation Upper Case Select
25.x-PI Line Paper Slew Using Binary Count	Emulation Configuration Printer Emulation Configuration P-Series XQ Emulation Slew Relative
	continued next page

Table A–7. MVP-150B/MVP-L150B to 6400 Conversion Table *(continued)*

MVP-150B/MVP-L150B Menu Option	IBM 6400 Menu Option
26.x-On-line Condition At Power Up	Printer Control Power On State
27.x-Paper Out Delay	N/A
28.x-Spaces With Auto-Underline	N/A
29.x-Delete Character Option (7Fh/FFh)	N/A
30.x-Print or Graphics Mode At Power On	Emulation Configuration Print Format Print Quality
31.x-Define Control Codes	N/A
32.x-Cedilla Character Set	N/A
33.x-Slash Zero	Emulation Configuration Print Format Print Attributes Slashed Zero
34.x-Alternate Plot Control Code (Even Dots)	N/A
35.x-Alternate Plot Control Code (Odd Dots)	N/A
36.x-Mode 1 Select	N/A
37.x-Mode 2 Select	N/A
38.x-Double High Select	N/A
39.x-Mode 3 Select	N/A
40.x-Additional Printable Characters	N/A
41.x-Extended Character Set Select	Emulation Configuration Printer Emulation Configuration P-Series / Serial Matrix Emulation Alternate Set 80-9F
42.x-EVFU Control	Emulation Configuration Printer Emulation Configuration P-Series Emulation EVFU Selected
continued next page	

Table A–7. MVP-150B/MVP-L150B to 6400 Conversion Table *(continued)*

MVP-150B/MVP-L150B Menu Option	IBM 6400 Menu Option
43.x-Plotting Exit	N/A
44.x-Print Buffer With TOF Switch	N/A
45.x-Mode 4	N/A
46.x-EVFU Control With No PI Line	N/A
47.x-SOH and ETX	Emulation Configuration Printer Emulation Configuration P-Series Emulation Select SFCC
48.x-Character Pitch In Mode 5 (Condensed Print)	N/A
49.x-Not Used	N/A
50.x-Page Perforation Skip	Emulation Configuration Print Format Perforation Skip
51.x-Lines Per Inch	Emulation Configuration Print Format Lines Per Inch
52.x-Forms Length At Power Up	Emulation Configuration Print Format Forms Length
53.x-Not Used	N/A
54.x-Line Spacing At Power Up	Emulation Configuration Print Format Lines Per Inch
55.x-Not Used	N/A
56.x-Column Print Spacing	Emulation Configuration Print Format Forms Width
57.x-Input Buffer Size	N/A
continued next page	

Table A–7. MVP-150B/MVP-L150B to 6400 Conversion Table *(continued)*

MVP-150B/MVP-L150B Menu Option	IBM 6400 Menu Option
58.x-ESC DC1 Sequence	Emulation Configuration Printer Emulation Configuration Epson / Serial Matrix Emulation Printer Select
59.x-150B / L150B Select	N/A
60.x-Data Line 8	Parallel Interface PC Parallel / Dataproducts Data Bit 8
61.x-PI Line	Parallel Interface Dataproducts PI Ignored
62.x-Data Strobe Polarity	Parallel Interface PC Parallel / Dataproducts Strobe Polarity
63.x-Data / Response Line Polarity	Parallel Interface PC Parallel Data Polarity Response Polarity Dataproducts Data Polarity Data Request Polarity
64.x-Not Used	N/A
65.x-Busy Line Handling	Parallel Interface PC Parallel Busy On Strobe
66.x-Interface Select	Printer Control Interface Selection Parallel Interface Interface Type
67.x Thru 99.x Are Not Used	N/A

Migrating from P300/P600 ASCII Printers

The Printronix P300/P600-Series ASCII printers were configured by means of switch settings rather than configuration menus. You may have a configuration chart that lists your current configuration. If not, you can determine your current printer configuration in two ways:

- Refer to a configuration chart you have maintained for your printer, or refer to the *User Manual* for your printer to interpret the switch settings for your printer and derive their configuration.
- Print the test file provided on diskette and determine the printer's configuration from the manner in which the test file prints.

Test File for Determining P300/P600 Printer Configuration

A test file is provided on diskette with your IBM 6400 printer, that will allow you to test what the current jumper settings are on a P300 or P600 printer. If you can, send the file to the P300/P600 printer from an attached IBM PC or other host system. Otherwise you may have to type the contents of this file on your host system, in order to send it to the printer.

NOTE: The test file is shown on the following pages in 9 cpi Courier font. If you will be typing in the file instead of sending the file from the diskette to the printer, it should be typed in at 10cpi (the default character size for most terminals).

The entire file is represented on the following pages. Expressions that begin with the caret (^) are control codes. They will not print when you send the file to a printer. The test file is self documenting; read the text within the file to determine how to interpret the printout from your printer. A README file on the diskette provides additional information about the test file.

The manner in which your previous printer prints the test file will indicate the settings for several configuration options. Once you have determined how your previous printer is configured for these parameters, you can then find the corresponding configuration for the 6400 printer in Table A–8. You will notice that the test file checks for some but not all of the parameters in Table A–8.

A list of the configuration parameters verified using the test file follows, in the order in which the parameters are verified in the test file.

- Primary and Extended fonts enabled or disabled. This test allows you to check the code page that is currently selected for your printer. If it is an extended code page, then Data Bit 8 is enabled for your current host interface (the Data Bit 8 parameter for the parallel interface is listed under the heading INTERFACE PARAMETER OPTIONS in Table A–8). You may also use the character set printout at the beginning of the test file to verify the contents of the character set (code page) currently in use at your site, so that you can select a code page that is similar for the 6400 printer you will be installing.
- Auto Line Feed enabled or disabled; corresponds to the Auto Line Feed (After Buffer Full) option (under the heading LINE SPACING OPTIONS) in Table A–8.
- Carriage Return (CR)=CR, or CR=CR+LF; corresponds to the CR=CR+LF option (under the heading LINE SPACING OPTIONS) in Table A–8.
- Compressed Print mode host datastream control code is 01, 03, or 09. This corresponds to the Compressed Print Mode option (under the heading SOFTWARE CONTROL CODE OPTIONS) in Table A–8.
- Draft Print mode host datastream control code is 02, 03, or 09. This corresponds to the Draft Print Mode option (under the heading SOFTWARE CONTROL CODE OPTIONS) in Table A–8.
- 132 character wide printing is enabled or disabled
- Elongated characters are selected by 08 or 0E. This corresponds to the Elongated Print/Alt. char. option (under the heading SOFTWARE CONTROL CODE OPTIONS) in Table A–8.
- Shift Out code is 08 or 0E
- Default/Alternate lpi setting is 6/8, 6/9, 6/10, 8/8, 9/9, or 10/10; corresponds to the Line Spacing option (under the heading LINE SPACING OPTIONS) in Table A–8.
- Uppercase only is enabled or disabled; corresponds to the Print Lowercase as Uppercase option (under the heading PRINT MODE OPTIONS) in Table A–8.
- EVFU is enabled or disabled; corresponds to EVFU Enable/Disable option (under the heading LINE SPACING OPTIONS) in Table A–8.
- Alternate Forms Length is enabled or disabled; corresponds to the Alternate Forms Length Select option (under the heading PRINTER SETUP OPTIONS) in Table A–8.

- Skip Over Perforation distance; corresponds to the Skip Over Perforation option (under the heading PRINTER SETUP OPTIONS) in Table A–8.
- Underlined text is enabled or disabled; corresponds to the Underline Enable/Disable option (under the heading PRINT MODE OPTIONS) in Table A–8.
- Mod Plot jumper is installed or not installed; corresponds to the Modified Plot option (under the heading GRAPHICS MODE OPTIONS) in Table A–8.

^HP300 ASCII CHART^M

^M
The following chart may be used to determine the character sets that are installed in a P300/P600/XQ printer.^M
^M
Bit 8 must be enabled in order to print both the Primary and Extended Fonts. If bit 8 is disabled, the upper columns (A0-FFH) will be a duplicate of the data that is in the lower columns. If the upper columns are blank, there is no Extended Font set installed in the printer.^M
^M
^M

ASCII	HEX	Char.	ASCII	HEX	Char.	ASCII	HEX	Char.	ASCII	HEX	Char.^M
33	21	!	88	58	X	143	8f		198	c6	Æ ^M
34	22	”	89	59	Y	144	90		199	c7	Ç ^M
35	23	#	90	5a	Z	145	91		200	c8	È ^M
36	24	$	91	5b	[	146	92		201	c9	É ^M
37	25	%	92	5c	\	147	93		202	ca	Ê ^M
38	26	&	93	5d	]	148	94		203	cb	Ë ^M
39	27	’	94	5e	^	149	95		204	cc	Ì ^M
40	28	(	95	5f	_	150	96		205	cd	Í ^M
41	29	)	96	60	‘	151	97		206	ce	Î ^M
42	2a	*	97	61	a	152	98		207	cf	Ï ^M
43	2b	+	98	62	b	153	99		208	d0	Ð ^M
44	2c	,	99	63	c	154	9a		209	d1	Ñ ^M
45	2d	-	100	64	d	155	9b		210	d2	Ò ^M
46	2e	.	101	65	e	156	9c		211	d3	Ó ^M
47	2f	/	102	66	f	157	9d		212	d4	Ô ^M
48	30	0	103	67	g	158	9e		213	d5	Õ ^M
49	31	1	104	68	h	159	9f		214	d6	Ö ^M
50	32	2	105	69	i	160	a0	\xa0	215	d7	\xd7 ^M
51	33	3	106	6a	j	161	a1	¡	216	d8	Ø ^M
52	34	4	107	6b	k	162	a2	¢	217	d9	Ù ^M
53	35	5	108	6c	l	163	a3	£	218	da	Ú ^M
54	36	6	109	6d	m	164	a4	¤	219	db	Û ^M
55	37	7	110	6e	n	165	a5	¥	220	dc	Ü ^M
56	38	8	111	6f	o	166	a6	¦	221	dd	Ý ^M
57	39	9	112	70	p	167	a7	§	222	de	Þ ^M
58	3a	:	113	71	q	168	a8	¨	223	df	ß ^M
59	3b	;	114	72	r	169	a9	©	224	e0	à ^M
60	3c	<	115	73	s	170	aa	ª	225	e1	á ^M
61	3d	=	116	74	t	171	ab	«	226	e2	â ^M
62	3e	>	117	75	u	172	ac	\xac	227	e3	ã ^M
63	3f	?	118	76	v	173	ad	\xad	228	e4	ä ^M
64	40	@	119	77	w	174	ae	®	229	e5	å ^M
65	41	A	120	78	x	175	af	¯	230	e6	æ ^M
66	42	B	121	79	y	176	b0	°	231	e7	ç ^M
67	43	C	122	7a	z	177	b1	±	232	e8	è ^M
68	44	D	123	7b	{	178	b2	\xb2	233	e9	é ^M
69	45	E	124	7c	|	179	b3	\xb3	234	ea	ê ^M
70	46	F	125	7d	}	180	b4	\xb4	235	eb	ë ^M
71	47	G	126	7e	~	181	b5	\xb5	236	ec	ì ^M
72	48	H	127	7f		182	b6	¶	237	ed	í ^M
73	49	I	128	80		183	b7	·	238	ee	î ^M
74	4a	J	129	81		184	b8	\xb8	239	ef	ï ^M
75	4b	K	130	82		185	b9	\xb9	240	f0	ð ^M
76	4c	L	131	83		186	ba	º	241	f1	ñ ^M
77	4d	M	132	84		187	bb	»	242	f2	ò ^M
78	4e	N	133	85		188	bc	¼	243	f3	ó ^M

```
 79     4f     O      134     86           189     bd     ½   244    f4    ô  ^M
 80     50     P      135     87           190     be     ¾   245    f5    õ  ^M
 81     51     Q      136     88           191     bf     ¿    246    f6    ö  ^M
 82     52     R      137     89           192     c0     À    247    f7  \xf7 ^M
 83     53     S      138     8a           193     c1     Á    248    f8    ø  ^M
 84     54     T      139     8b           194     c2     Â    249    f9    ù  ^M
 85     55     U      140     8c           195     c3     Ã    250    fa    ú  ^M
 86     56     V      141     8d           196     c4     Ä    251    fb    û  ^M
 87     57     W      142     8e           197     c5     Å    252    fc    ü  ^M
                                                             253    fd    ý  ^M
                                                             254    fe    þ  ^M ^M
^M
^M
^M
^LThis portion of the test file is used to determine the settings of the jumpers
on the logic A/B controller boards of the P300 / P600 printers.^M

^M
^M
AUTO LINE FEED ENABLE JUMPER^M
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXX^M
If there are two lines of "X's" then the Auto Line Feed is enabled^M
If there is only one line of "X's" then Auto Line Feed is disabled^M
^M
^M

CARRIAGE RETURN AND LINE FEED JUMPER^M
OOOOOO^MXXXXXX^M
If there is a line of "O's" followed by a line of "X's" then CR=CR+LF^M
If the "O's" have been replaced by the "X's" then CR=CR^M

^M
^M
COMPRESSED / DRAFT PRINT JUMPER^M
^AIf this is Compressed Printing then Code 01 selects Compressed Print^M
^CIf this is Compressed Printing then Code 03 selects Compressed Print^M
If this is Compressed Printing then Code 09 selects Compressed Print^M

^BIf this is Draft Printing then Code 02 selects Draft Print
^CIf this is Draft Printing then Code 03 selects Draft Print
^IIf this is Draft Printing then Code 09 selects Draft Print

132 CHARACTERS = AUTO LINE FEED
^AXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
^CXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
^IXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

If one of the lines above is printed in compressed print and the line wraps at^M
132 characters then the 132 CHARACTERS jumper is installed. (If the text is
not^M
compressed, this test is invalid.)^M

ELONGATED CHARACTER / SHIFT OUT CONTROL CODE JUMPER^M
^HIf this is Elongated then Code 08 selects Enlongated Characters^M
```

```
^NIf this is Elongated then Code 0E selects Enlongated Characters^M
^M
^NABCDEFGHIJKLMNOPQRSTUVWXYZ^M
If the previous line was not the standard alphabet (or the line^M
is blank) then Code 0E is the Shift Out code^M
^NABCDEFGHIJKLMNOPQRSTUVWXYZ^M
If the previous line was not the standard alphabet (or the line^M
is blank) then Code 08 is the Shift Out code^M
^M
^M
LINE SPACING JUMPER^M
Line Spacing Test Mode 1^M
Line Spacing Test Mode 1^M
Line Spacing Test Mode 1^M
Line Spacing Test Mode 1^M
Line Spacing Test Mode 1^M
Line Spacing Test Mode 1^M
^FLine Spacing Test Mode 2^M
^FLine Spacing Test Mode 2^M
^FLine Spacing Test Mode 2^M
^FLine Spacing Test Mode 2^M
^FLine Spacing Test Mode 2^M
^FLine Spacing Test Mode 2^M
^M
If the Lines in Mode 1 are at 6 LPI and the lines in Mode 2 are at 8 LPI^M
then 6 LPI is the default and 8 LPI is the alternate^M
If the Lines in Mode 1 are at 6 LPI and the lines in Mode 2 are at 9 LPI^M
then 6 LPI is the default and 9 LPI is the alternate^M
If the Lines in Mode 1 are at 6 LPI and the lines in Mode 2 are at 10 LPI^M
then 6 LPI is the default and 10 LPI is the alternate^M
If the Lines in Mode 1 and the lines in Mode 2 are both at 8 LPI^M
then 8 LPI ONLY is enabled^M
If the Lines in Mode 1 and the lines in Mode 2 are both at 9 LPI^M
then 9 LPI ONLY is enabled^M
If the Lines in Mode 1 and the lines in Mode 2 are both at 10 LPI^M
then 10 LPI ONLY is enabled^M
PRINT LOWERCASE AS UPPERCASE JUMPER^M
abcdefghijklmnopqrstuvwxyz^M
If the previous line was printed as all UPPERCASE characters then^M
Uppercase ONLY is selected.^M
^M
^M
EVFU ENABLE / DISABLE JUMPER^M
If this line is not split ^Uthen the EVFU is disabled.^M
If this line is split ^Uthen the EVFU is enabled.^M
^LALTERNATE FORMS LENGTH JUMPER^M
Measure the distance from the Alternate Forms Length Jumper header to^M
the next measure line.^M
^LMeasure to here.^M
If the distance is 11 inches then the Alternate Forms Length is disabled.^M
If the distance is 12 inches then the Alternate Forms Length is enabled.^M
^LSKIP OVER PERF. JUMPER^M
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
```

```
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

^M
Check for any blank space between the lines of "X's".^M
Measure any blank space.  This is the Skip Over Perf. distance^M

UNDERLINE JUMPER^M
Is this underlined?^M__ ____ ___________^M

If the line above is underlined, the underline jumper is not installed^M
If the line above is blank, the underline jumper is installed^M
^M
^M

MOD PLOT JUMPER^M
^E????????????????????????????????????^M
^E????????????????????????????????????^M
^E????????????????????????????????????^M
AND SOME MORE TEXT - IS IT ALL THERE?^M
If the line of text above is complete, then the 'Mod Plot' jumper is
installed.^M
If the line of text above has the first three dot rows 'over-printed' by the^M
plot data, then the 'Mod Plot'jumper is not installed.^M

^M
^M
^M

End of program^M

^M
^M
^M

P300/600 JUMPER CONFIGURATION VERIFICATION TEST DISK,  PN 141997,  v1.00A^M
COPYRIGHT 1995 PRINTRONIX, INC.^M
^M

^L^L^Z
```

P300/P600 to 6400 Conversion Table

Table A–8 lists the configuration options for the P300/P600 printers that are selected via settings on the printers' controller boards. Once you have determined the configuration for the P300/P600 printer at your site, you may wish to make a xerox copy of this table and pencil in your previous printer's configuration. You can then configure equivalent option values for the 6400 once it is installed and ready to be configured.

Table A–8. P300/P600 to 6400 Conversion Table

P300/P600 Configuration Option	IBM 6400 Menu Option
PRINT MODE (TEXT) OPTIONS	
Print Lowercase As Uppercase	Emulation Configuration Printer Emulation Configuration P-Series XQ Emulation Upper Case Select
Underline Enable / Disable	N/A
Select 7,8, Or 9 Dot Rows	N/A
Default Print Mode Select	Emulation Configuration Print Format Print Quality
LINE SPACING OPTIONS	
Auto Line Feed (After Buffer Full)	Emulation Configuration Printer Emulation Configuration P-Series XQ Emulation Auto LF
CR = CR + LF	Emulation Configuration Printer Emulation Configuration P-Series XQ Emulation Define CR Code
EVFU Enable / Disable	Emulation Configuration Printer Emulation Configuration P-Series XQ Emulation EVFU Selected
	continued next page

Table A–8. P300/P600 to 6400 Conversion Table *(continued)*

P300/P600 Configuration Option	IBM 6400 Menu Option
LINE SPACING OPTIONS (continued)	
Line Spacing	Emulation Configuration Print Format Lines Per Inch
INTERFACE PARAMETER OPTIONS	
	Printer Control Interface Selection Parallel Interface Interface Type
Inverted I/O Polarity	Parallel Interface PC Parallel / Dataproducts Data Polarity Response Polarity Data Request Polarity
Inverted Data Strobe	Parallel Interface PC Parallel / Dataproducts Strobe Polarity
Data Bit 8	Parallel Interface PC Parallel / Dataproducts Data Bit 8
PI Line	Parallel Interface Dataproducts PI Ignored
Move One Line Binary Count	Emulation Configuration Printer Emulation Configuration P-Series XQ Emulation Slew Relative
	continued next page

Table A–8. P300/P600 to 6400 Conversion Table *(continued)*

P300/P600 Configuration Option	IBM 6400 Menu Option
ERROR HANDLING OPTIONS	
Paper Motion Detect	Printer Control Paper Jam Detection
Paper Out Delay	N/A
GRAPHICS MODE OPTIONS	
Double Speed Plot	N/A
Even Dot Plot	N/A
Modified Plot	N/A
PRINTER SETUP OPTIONS	
P-300 / P-600 Select	N/A
Phase Fire Enable	N/A
Skip Over Perforation	Emulation Configuration Print Format Perforation Skip
Alternate Forms Length Select (12”)	Emulation Configuration Print Format Forms Length
SOFTWARE CONTROL CODE OPTIONS	
Elongated Print / Alt. char.	Emulation Configuration Printer Emulation Configuration P-Series XQ Emulation Elong/Alt. Font
Compressed Print Mode	Emulation Configuration Printer Emulation Configuration P-Series XQ Emulation Compressed Print
Draft Print Mode	Emulation Configuration Printer Emulation Configuration P-Series XQ Emulation High Speed Print Mode

Selecting a Communications Interface and Cables

The following host computer interface choices are available for the 6400 printer:

- PC-Parallel (may also be referred to as Centronics parallel)
- Dataproducts Parallel
- RS-232 Serial
- RS-422 Serial

The 6400 configuration menus allow you to select one of these interfaces from the printer's configuration menus, starting from the "Printer Control" menu, as described in the *IBM 6400 Line Matrix Printer Setup Guide (P/N S246-0116)*, Chapter 4. The signals and pinouts for cables that can be used with each of these host interfaces are described in Chapter 5 of the *Setup Guide*.

Your choice for the host interface and cables to install from the printer to the host depends on the installation at your site, as follows:

- **The 6400 printer replaces a previous Printronix printer, and you still have the cables that were used with that printer:**

  In this situation, the simplest choice is to reuse the existing cables and configure the 6400 printer for the host interface that matches the previous printer's configuration. (This assumes that the previous printer was configured for one of the four interfaces listed above.) If you are using a Dataproducts interface, you will need an adapter to attach from your Dataproducts cable to the parallel port on the IBM 6400 printer. This adapter can be ordered from an IBM Remarketeer.

- **The 6400 printer replaces a previous Printronix printer, but you do not have the cables used with the previous printer, or you are adding a 6400 to your previous Printronix printers:**

  In this situation, it is recommended that you configure the new printer for an interface that is compatible with the host that you wish to attach. If you will use a Dataproducts interface, you will need an adapter to attach from your Dataproducts cable to the parallel port on the IBM 6400 printer. This adapter can be ordered from an IBM Remarketeer.

Troubleshooting

The following table describes selected print formatting / host interface problems that may be encountered when initially configuring an IBM 6400 printer to match a preexisting product and the action(s) to be taken to resolve the problem. The symptoms presented are generic in nature and are not intended to represent all possible combinations of problems that may be observed. They should be used as a general guide when troubleshooting the host / printer configuration.

Table A–9. Symptom / Action Table for IBM 6400 Printer

Symptom	Action
Line Spacing does not match existing application file format	Under PRINT FORMAT check: Lines Per Inch Forms Width Forms Length Margins Perforation Skip
	Under PRINTER EMULATION CONFIGURATION check: Define CR Auto LF Define LF FF Valid At TOF Control Code 06 EVFU Selected Slew Relative
	Under PARALLEL INTERFACE check: PI Ignored (note: PI slew is no longer supported under Centronics interface)
	continued next page

Table A–9. Symptom / Action Table for IBM 6400 Printer *(continued)*

Symptom	Action
Character font does not match existing application file format	Under PRINT FORMAT check: Characters Per Inch Print Quality Italic Print
	Under PRINTER EMULATION CONFIGURATION check: Alternate Set 80-9F Compressed Print Elong/Alt Font High Speed Print Mode Print Language Character Sets Upper Case Select Control Code 08 20 CPI Condensed
	Under PARALLEL / SERIAL INTERFACES check: Data Bit 8 Data Bits
Text formatting does not match existing application file format	Under EMULATION CONFIGURATION check: ASCII Printer Emulation
	Under PRINTER EMULATION CONFIGURATION check: Select SFCC Control Code 08 Elong/Alt Font Upper Case Select Overstrike
	continued next page

Table A–9. Symptom / Action Table for IBM 6400 Printer *(continued)*

Symptom	Action
Text formatting does not match existing application file format *(continued)*	Under PRINT FORMAT check: Forms Width Forms Length Proportional Spacing Margins Perforation Skip
Host interface character buffer overrun	Under PARALLEL INTERFACE check: Busy On Strobe
	Under SERIAL INTERFACE check: Data Protocol Data Terminal Ready Request To Send
Host interface framing / parity errors multiple strobing of characters missing characters incorrect characters	Under PARALLEL INTERFACE check: Strobe Polarity Latch Data On Response Polarity Busy On Strobe Prime Signal Data Polarity Data Request Polarity
	Under SERIAL INTERFACE check: Baud Rate Data Bits Stop Bits Parity
	continued next page

Table A–9. Symptom / Action Table for IBM 6400 Printer *(continued)*

Symptom	Action
Host interface framing / parity errors (*continued*)	Data Protocol Data Terminal Ready Request To Send
Host interface not communicating with printer	Under PARALLEL INTERFACE check: Interface Type Strobe Polarity Response Polarity
	Under SERIAL INTERFACE check: Interface Type
	Under PRINTER CONTROL check: Interface Selection
	Hardware Interface Options check: I/O Resistor Pack Values I/O Cabling

Contacting IBM Technical Support

If you are experiencing difficulty with installation of the IBM 6400 printer in order to replace a previous printer, please contact your authorized IBM service representative for assistance.

B

Attaching Host Systems to an ASCII Printer

Contents

Overview

This section provides guidelines for preparing host computers with several different operating systems for use with your IBM 6400 ASCII printer. Before you can send data files to an ASCII printer from a host computer, cabling must be installed to attach the host to the printer; in addition, the printer and the host must be configured for compatible emulations and host interface (port) parameters. For the AIX host operating system, additional operating system configuration procedures must be completed.

You may need to change your printer's configuration in order to ensure compatibility with your host computer. For tutorial information on configuring your printer using the configuration menus and LCD display, refer to the *IBM 6400 Line Matrix Printer Setup Guide (P/N S246–0116).*

Attaching a DOS Workstation

Preparing a DOS workstation for use with an IBM 6400 ASCII printer includes attaching either serial or parallel cabling between the workstation and the printer, selecting a DOS–compatible print driver, and configuring the workstation's serial or parallel port for compatibility with your printer.

Follow these steps when attaching your printer to a workstation that uses uses the Disk Operating System, Version 3.3 or later:

1. Attach either PC–parallel or RS–232 serial cabling between the printer and your DOS workstation. During installation of the cabling, make sure that the printer and the workstation are powered off.

2. Once cabling is installed, power back on the printer and the DOS workstation.

3. Verify that your printer has the Interface Selection option on the Printer Control menu set to match the installed cabling (either serial or parallel). In addition, if parallel cabling is installed, then PC-Parallel should be selected from the Parallel Interface menu. If serial cabling is installed, then RS-232 should be selected from the Serial Interface menu.

4. Select a print driver. DOS (Version 3.3 or later) does not provide print drivers. You will need to select a print driver from the application software you will be using to send data files to the printer.

Most application software packages provide several print drivers; following the instructions provided with your application software, select one of the following two print drivers to ensure compatibility with your printer:

- Epson FX-1050
- IBM Proprinter III XL

Make sure that the print driver you choose matches the emulation you have selected from the printer's ASCII Emulation menu. For instance, if you have selected the Epson emulation from the printer menus, then choose the Epson FX-1050 print driver form your application software.

NOTE: If your application does not supply a print driver for either of the above printers, select a print driver that supports the printer that is most similar to the Epson FX-1050 or IBM Proprinter III XL.

5. Depending on which type of interface cabling you have installed between the printer and the workstation, you must now set either parallel or serial port parameters for your workstation using the DOS MODE command. Following is a list of the parameters you will need to set for a parallel port or a serial port, using the MODE command.

NOTE: Verify that the values you select using the MODE command match the values you have selected from your IBM printer's Parallel Interface or Serial Interface menu. You may need to change your printer's configuration in order to match the DOS workstation configuration.

a. **Parallel port.** Use the MODE command to select values for the following parallel interface parameters (and verify that the same values are selected from the printer's Parallel Interface menu):

- *Lpt* identifies the parallel port to which you want to send print jobs, which is LPT1, LPT2, or LPT3. This must match the port connector on the host system where cabling to the printer is installed

- *Cols* specifies the forms width in terms of the number of characters. Choose between 80 and 132 columns.

- *Lines* specifies 6 or 8 lines per inch. Make sure that the value you select here matches the value you choose on the printer's operator panel under Print Format/Lines Per Inch.

- *Retry* specifies the retry action. Choose any of these options:

  e – return an error from a status check of a busy port.

  b – return busy from a status check of a busy port.

  p – continue retrying until printer accepts output.

  r – return ready from a status check of a busy port.

  n – take no retry action. (Also can specify none.)

b. **Serial port.** Use the MODE command to select values for the following serial interface parameters (and verify that the same values are selected from the printer's Serial Interface menu):

- *Baud rate* should be one of the following values: 300, 600, 1200, 2400, 4800, 9600, or 19200. If your version of DOS and your workstation support a higher baud rate, you can select up to 115,200.

- *Data bits* must be either 8 or 7.

- *Stop bits* must be either 1 or 2. Do not use the stop bit of 1.5.

- *Parity* must be one of these values: none, odd, even, or mark. Do not use the sense parity value.

- *Retry* specifies the retry action. Choose any of these options:

  e – return an error from a status check of a busy port.

  b – return busy from a status check of a busy port.

  o – continue retrying until printer accepts output.

  r – return ready from a status check of a busy port.

  n – take no retry action. (Also can specify none.)

Attaching a Windows Workstation

Configuring a Windows workstation for use with an IBM 6400 printer includes attaching either serial or parallel cabling between the workstation and the printer, selecting a compatible print driver, and configuring the workstation's serial or parallel port for compatibility with your printer.

Follow these steps when attaching your printer to a workstation that uses Microsoft Windows 3.1 or later:

1. Attach either PC–parallel or RS–232 serial cabling between your printer and your Windows workstation. Make sure that the printer and the workstation are powered off during installation of the cabling,
2. Once cabling is installed, power back on the printer and the Windows workstation.
3. Verify that your printer has the Interface Selection option on the Printer Control menu set to match the installed cabling (either serial or parallel). In addition, if parallel cabling is installed, then PC-Parallel should be selected from the Parallel Interface menu. If serial cabling is installed, then RS-232 should be selected from the Serial Interface menu.
4. From your Windows workstation, select a print driver from the Windows Print Manager that supports either an IBM Proprinter III XL or an Epson FX-1050 printer.
   a. Open the Windows Print Manager icon. (Usually, the icon for the Print Manager is located within the Main group.)
   b. From the Print Manager Options menu, select Printer Setup.
   c. Within Printer Setup, select Add and choose a printer from the List of Printers box. Choose either IBM Proprinter III XL or Epson FX-1050.

NOTE: The print driver you select in Windows must be the same as the emulation selected for your printer from the ASCII Printer Emulation menu. You may need to change your printer's configuration

   d. Select Install.
5. Once you have selected Install, you will need to connect the printer to either a parallel or serial port from Windows. Select the Connect button, then define the port on the workstation to which the cabling is attached. Specify either LPT1, LPT2, or LPT3 for a parallel port. Specify COM1, COM2, or COM3 for a serial port.

6. *If you have selected a serial communications port* – Select Settings from within Windows, and choose values for the following serial interface parameters.

NOTE: Verify that the values you select match the values you have selected from your IBM printer's Serial Interface menu. You may need to change your printer's configuration in order to match the DOS workstation configuration.

- *Baud rate* should be one of these values: 300, 600, 1200, 2400, 4800, 9600, or 19200. Please note that Windows does not offer 150 baud rate as an option but instead offers 110. Please avoid setting the printer baud rate at 150 and avoid using the Windows setting of baud rate 110. If your version of Windows and your workstation support higher baud rates, you can select up to 115,200.

- *Data bits* must be either 8 or 7.

- *Stop bits* must be either 1 or 2. Do not use the Windows stop bit of 1.5.

- *Parity* must be one of these values: none, odd, even, mark, and sense. Do not use the sense parity value.

- *Flow control* must be Xon/Xoff. Do not use the Hardware or None values.

Attaching an OS/2 Workstation

Configuring an OS/2 workstation for use with an IBM 6400 printer includes attaching either serial or parallel cabling between the workstation and the printer, selecting a compatible print driver, and configuring the workstation's serial or parallel port for compatibility with your printer.

Follow these steps when attaching this printer to a workstation using OS/2 2.1 or latter:

1. Attach either PC–parallel or RS–232 serial cabling between your printer and your Windows workstation. Make sure that the printer and the workstation are powered off during installation of the cabling,
2. Once cabling is installed, power back on the printer and the Windows workstation.
3. Verify that your printer has the Interface Selection option on the Printer Control menu set to match the installed cabling (either serial or parallel). In addition, if parallel cabling is installed, then PC-Parallel should be selected from the Parallel Interface menu. If serial cabling is installed, then RS-232 should be selected from the Serial Interface menu.
4. Create a printer object from your OS/2 workstation by opening the Templates folder and dragging the Printer Template to a folder or available place on your desktop.
    a. If you have an existing printer object on your desktop, then open the printer object and select Create Another.
5. Type a unique name to identify the printer. You may want to use a name such as 64XX Proprinter III XL or 64XX Epson FX-1050 to help identify which of the printer emulations you are using.
6. Select the printer driver that matches the printer emulation you selected on the operator panel under Printer Emulation. Your choices are IBM Proprinter III XL or Epson FX-1050.
    a. Make sure that the printer driver you select matches the printer emulation you selected on the operator panel under ASCII Printer Emulation.

7. After you install the printer driver, you will need to connect the printer to either a parallel or serial port. Select a port in the Output Port field for either parallel or serial communications:

   a. If you have installed cabling to a parallel port, select LPT1, LPT2, or LPT3, depending on which port has cabling installed.

   b. If you have installed cabling to a serial port, select COM1, COM2, or COM3, depending on which port has cabling installed.

8. *If you have selected a serial communication port*, a panel will be displayed where you set the following values to match the values you selected via the printer's Serial Interface menu:

NOTE: Verify that the values you select match the values you have selected from your IBM printer's Serial Interface menu. You may need to change your printer's configuration in order to match the DOS workstation configuration.

- *Baud rate* should be one of these values: 150, 300, 600, 1200, 2400, 4800, 9600, or 19200. If your version of OS/2 and your workstation support higher baud rates, you can select up to 115,200.
- *Data bits*, which is the same as Word Length, must be either 8 or 7.
- *Stop bits* must be either 1 or 2. Do not use the stop bit of 1.5.
- *Parity* must be one of these values: none, odd, or even.
- *Handshake* should be set to the default value which is hardware.
- *Timeout* should be set to the default value which is 45 seconds.

9. Select Create or OK to create the printer object.

Attaching an AIX Workstation

This section provides a description of the 6400 printer drivers and colon files (virtual printers) for AIX. You can also this information as a guide for installing this printer on a UNIX workstation.

NOTE: UNIX operating systems do not provide the AIX System Management Integration Tool (SMIT). So for examples where SMIT is used, please refer to your UNIX documentation for the equivalent UNIX command. This also applies if you do not use SMIT on AIX; you can use the equivalent AIX command instead.

Read This

The 6400 printers are supported on AIX operating system version 3.2.5 or later by printer colon files. These printer colon files are available on a print driver diskette or may be included in the operator system. If the print driver diskette was not shipped with your printer or the printer colon files are not part of the base operator system, contact your IBM Authorized Remarketeer or IBM Marketing Representative.

NOTE: The print driver diskette includes a *readme* file that you should review. The *readme* file contains additional information not provided in this document.

The files are currently delivered on a DOS formatted diskette with two files. The first file is 64xx.readme, which contains this information. The second file is 64xx.tar, which contains all the drivers and additional information files.

To read the diskette from AIX, change your directory to where you want to copy the files, then issue the following commands:

```
dosread –a 64xx.readme 64xx.readme
dosread 64xx.tar 64xx.tar
```

Unpack the tar file with the following command

```
# tar –xvf 64xx.tar
```

The installation commands must be run as super user (root). To install the 64xx driver, type:

```
# add_64xx
```

This places the colon files in /usr/lib/lpd/pio/predef, and adds the device to the Object Database Manager database.

When these colon files have been installed, you will be able to add a 6400 printer as a printer device, and add virtual printers as a 6400 in three emulation modes; IBM Proprinter III XL, Epson FX-1050, and Printronix P-Series. You cannot automatically switch between emulations, so the emulation mode you choose must match what you selected on the printer operator panel under ASCII Printer Emulation. For instance, if you chose IBM Proprinter III XL, then you must attach this printer to your AIX workstation as an IBM Proprinter III XL.

Installing an AIX Printer Device

NOTE: For detailed instructions, consult your AIX documentation. Additionally, an excellent source of information for installing and configuring printers on an AIX workstation is *Printing for Fun and Profit Under AIX 3*, GC24–3570.

To add a printer device to AIX, Versions 3.2 or latter, use System Management Integration Tool (SMIT), and follow these steps:

1. Logon as a user with appropriate administration privileges, such as root or as a member of the **printq** administration group.
2. Enter the SMIT menu with the following command: **smit printer**
   This command takes you directly to the *Printer/Plotter Devices* menu.

   (Alternatively, you may simply enter: **SMIT**
   This command presents the introductory SMIT menu. From the SMIT menu, you may then traverse to *Devices*, then *Printer/Plotter,* and then *Printer/Plotter Devices*.)
3. From within the SMIT menus, select *Printer/Plotter Devices*.
4. Select *Add a Printer/Plotter.*
5. Use the "Down" arrow key to locate, then choose: *IBM 64XX Printer.* (Do not select the Printronix P9012 Line Printer as this will produce unexpected results.)
6. Select the *Printer/Plotter interface.*
7. Choose from Parallel, RS-232, or RS-422. The interface you choose must match your printer's Interface Selection setting. (If you choose Serial, you must also match your printer's Serial Interface Type setting.)

8. Once you have selected an interface, a panel titled *Add A Printer/Plotter* will display. Some values will already be filled in; you will need to select others, as described below:

   a. *Printer/Plotter type* is 64XX.

   b. *Printer/Plotter interface* should be either parallel, RS-232, or RS-422.

   c. *Description* is IBM 64XX printer.

   d. *Parent adapter* is either sa1 or sa0.

   e. *PORT number.* You select the port number. Default is same as the parent adapter. For instance, if you make the parent adapter sa1, then default PORT number is sa1.

   f. *Baud rate.* The default is 9600. Your choices are 150, 300, 600, 1200, 2400, 4800, 9600, and 19200. Select the baud rate that matches your printer's setting for Baud Rate in the Serial Interface menu.

   g. *Parity.* The default setting is none. You can choose either None, Even, or Odd. Select Parity that matches your printer's setting for Parity in the Serial Interface menu. (Do not set the printer for Mark or Sense as these are not supported by AIX.)

   h. *BITS per character* is the same as Data Bits. The default is 8. Your choices are 7 or 8. Select a BITS per character value that matches your printer's setting for Data Bits in the Serial Interface menu. (Do not set use the AIX options of BITS per character of 5 or 6 as these are not supported by the printer.)

   i. *STOP BITS.* The default is 1. You can select 1 or 2. Select a value for STOP BITS that matches your printer's setting for STOP BITS in the Serial Interface menu.

   j. *XON–XOFF handshaking.* The default is Yes. Xon/Xoff is always on, so you do not have to set any parameters on the printer's serial interface menu.

   k. *Sticky XON/XOFF flow control.* The default is No. Use this default.

   l. *Use DTR communication protocol* is the same as Data Terminal Ready. The default is yes. Select a DTR communication protocol setting that matches your printer's setting for Data Terminal Ready (Yes=True and No=false).

m. *TRANSMIT buffer count.* The default is 64. Use the default value.

n. *Printer TIME OUT period.* The default is 60. Use the default value.

9. After you have completed selecting values for the *Add a Printer/Plotter* panel, press **Enter** or select **Do** to save your changes. Your printer has now been added to the AIX operating system.

10. To test if your printer is properly attached, at the command line, type: **cat /etc/qconfig > /dev/lpnn**,
where **lpnn** is the printer device number assigned to the printer, such as s1, which would be entered as **lps1**. This should print out the contents of the /etc/qconfig file.

Adding a Virtual Printer to AIX

To add a virtual printer to AIX, Versions 3.2 or latter, use the System Management Integration Tool (SMIT), and follow these steps:

1. Logon as a user with appropriate administration privileges.

2. Enter the SMIT menu with the following command: **smit printer**
This command takes you directly to the *Printer/Plotter Devices* menu.

   (Alternatively, you may simply enter: **SMIT**
   This command presents the introductory SMIT menu. From the SMIT menu, you may then traverse to *Devices*, then *Printer/Plotter,* and then *Printer/Plotter Devices*.)

3. From within the SMIT menu, select *Printer/Plotter Devices*.

4. Select *Manager Local Printer Subsystem.*

5. Select *Add a Virtual Printer.*

6. Make a selection from the following list, that begins *Select Printer or Plotter Attached to Host.* If you attached this printer to an Xstation or some other LAN connection, select the appropriate option.

   Printer or Plotter Attached to Host

   Printer or Plotter Attached to Xstation

   Printer or Plotter Attached to ASCII Terminal

   Network Printer (Hewlett–Packard JetDirect)

   Printer or Plotter Attached to IBM 4033 LAN Connection

   Printer Attached to IBM Integrated Network Option

   Network Printer (Hewlett–Packard JetDirect)

7. For *device name*, select lp0 (match number of printer added).

8. For *header pages*, choose from these three options: none, each file, or each job.

9. For *trailer pages*, choose form these three options: none, each file, or each job.

10. Press the **Enter** key. The following menu selections will be displayed. Since the 64XX printer supports multiple data streams, a print queue will be created for each data stream. This enables you to send print jobs to a print queue that supports the printer you are emulating, such as a Proprinter or Epson.

```
------------------  IBM Proprinter III XL Emulation
------------------
Enter print queue name (or, ! to bypass configuration): -> (pro)
6404pro
Should this queue be the default queue? -> (y)  n
--------------------  Printronix P-Series Emulation
------------------
Enter print queue name (or, ! to bypass configuration): -> (pri)
6404pri
Should this queue be the default queue? -> (y)  n
--------------------  Epson FX 1050 Emulation  ------------------
Enter print queue name (or, ! to bypass configuration): -> (eps)
6404eps
Should this queue be the default queue? -> (y)  n
```

Figure B–1. AIX Print Queue Creation

Printing to an AIX Attached Printer

You can use standard AIX (UNIX) print commands including: **lp**, **lpr**, **enq**, and **qprt**. The **qprt** command supports a large range of commands for selecting pitch and print styles. For information on specific flags you can use with the **qprt** command, refer to the following subsections:

- Printing in Proprinter III XL Emulation Mode
- Printing in Epson FX-1050 Emulation Mode
- Printing in P-Series Emulation Mode

Here are some examples of AIX (UNIX) print commands:

```
qprt –P64xxpro /etc/motd
enq –P64xxeps /etc/qconfig
lptest 50 50 | lp –d64xxpri
```

Printing in Proprinter III XL Emulation Mode

The **&64xx.** colon file for the Proprinter III XL emulation follows the same conventions as the Proprinter III XL virtual printer driver with only minor exceptions. The major enhancement is the full support of the 20 pitch fonts. Some of the most commonly used **qprt** print command flags are described in Table B–1. The virtual printer attributes that correspond to each flag value begin with an underbar and have the same character as the flag character.

For pitch, the &64xx. virtual printer supports 10, 12, 17, and 20 pitch in Proprinter III XL mode. Although the printer supports a pitch of 15, this is not supported by this print driver.

You may select pitch using the flags shown in Table B–1 with the **qprt** command. Double–wide character printing is also supported.

Table B–1. Proprinter III XL Emulation

Function	Flag and Attribute	Note
10 Pitch	–p10	Default
12 Pitch	–p12	
17 Pitch	–k+	
20 Pitch	–K+ –p12	Requires both flags.
20 Pitch	–W+	
136 page width	–w 136	Default
Draft printing	–q0	Usually used with 12 cpi
DP (Data Processing)	–q1	Default
DP (Data Processing)	–q2	NLQ (Near Letter Quality)
OCR A	–q3	Only supports 10 pitch; do not use with other pitch sizes. Overrides other character attributes.
Italic print	–sitalic	Can be used with all modes. Forces NLQ mode.
Double Strike	–y+	Can be used with all modes.
Emphasized	–e+	Can be used with all modes.
8 lines per inch	–v8	Default is 6; only 6 and 8 lines per inch are valid.
Unidirectional printing	–U+	

The default page width is 136 characters and the default page length is 66 lines. The page width and length adjust automatically with the different pitches and line densities. For example:

- Page width is 163 characters at pitch 12.
- Page width is 233 characters at a pitch of 17.
- Page width is 271 characters at a pitch of 20.
- Page length is 88 lines at 8 lines per inch.

For additional printer flags, review the **qprt** command. You can view more information on the **qprt** command by typing **man qprt** from an AIX command line.

Printing in Epson FX-1050 Emulation Mode

The &64xx. colon file for the Epson emulation takes advantage of most of the functions of the Epson escape sequences. Some enhancements have been added in support of 15–pitch printing, and in support of additional print quality modes beyond the two defined for the Epson emulation.

The page width cannot be set in Epson emulation mode, and therefore must be set from the front panel of the 6400 printer. The settings must be saved as the power on custom set, and the printer powered off and back on for the these settings to take effect. If this is not done, the data stream will reset the width to the power on condition with the ESC@ command that resets the printer.

Some of the most commonly used **qprt** print command flags for the Epson emulation are shown in Table B–2.

Table B–2. Epson FX-1050 Emulation

Function	Flag and Attribute	Note
10 Pitch	–p10	Default
12 Pitch	–p12	
17 Pitch	–p17	
20 Pitch	–p20	Requires both flags.
20 Pitch	–W+	
–w 136	Default	
DP	–q0	Data Processing
NLQ	–q1	Near Letter Quality [1]
High Speed DP	–q2	Default Data Processing
OCR A	–q3	Only supports 10 pitch; do not use with other pitch sizes. [2]
Italic print	–sitalic	Can be used with all modes.
Double Strike	–y+	Can be used with all modes.
Emphasized	–e+	Can be used with all modes.
Double high	–E+	Can be used with all modes.
8 lines per inch	–v8	Default is 6; only 6 and 8 lines per inch are valid.
Unidirectional printing	–U+	
[1] Combining NLQ and 20 pitch produces 17 cpi printing.		
[2] –p flags will be ignored and may cuase probems in OCR quality mode. In addition, doublewide, double-high, and italic do not work in OCR mode.		

The default page width is 136 characters, and the default page length is 66 lines. The page width and length adjust automatically with the different pitch and line density. For example:

- Page width is 163 characters at pitch 12.
- Page width is 204 characters at a pitch of 15.
- Page width is 233 characters at a pitch of 17.
- Page width is 260 characters at a pitch of 20.
- Page length is 88 lines at 8 lines per inch.

For additional printer flags, review the **qprt** command. You can view more information on the **qprt** command by typing **man qprt** from an AIX command line.

Printing in P-Series Emulation Mode

NOTE: Set the SFCC value on the printer to 27 (Hex 1B), or the virtual printer will not work. See the *IBM 6400 Line Matrix Printer Setup Guide (P/N S246–0116)* for instructions on setting this value. The forms length must be set manually from the front panel in addition to the use of the –l flag.

The &64xx. colon file for the Printronix P-Series Emulation takes advantage of most of the functions of the Printronix escape sequences.

Some of the most commonly used **qprt** print command flags for the P-Series emulation are shown in Table B–3.

Table B–3. Printronix P-Series Emulation

Function	Flag and Attribute	Note
10 Pitch	–p10	Default
12 Pitch	–p12	
13 Pitch	–p13	
15 Pitch	–p15	
17 Pitch	–p17	
20 Pitch	–K+ –p12	Requires both flags.
20 Pitch	–W+	
136 page width	–w 136	Default
High Speed	–q0	120 by 48 dpi
OCR–A	–q1	120 by 144 dpi; use with pitch 10 flag only; all other pitch flags ignored
DP	–q2	120 by 72 dpi Data Processing
NLQ	–q3	180 by 96 dpi Near Letter Quality
Double Strike	–y+	Can be used with all modes.
Emphasized	–e+	Can be used with all modes.
8 lines per inch	–v8	Default is 6; only 6 and 8 lines per inch are valid.
Unidirectional printing	–U+	

The default page width is 136 characters, and the default page length is 66 lines. The page width and length adjust automatically with the different pitch and line density. For example:

- Page width is 163 characters at pitch 12.
- Page width is 178 characters at pitch 13.
- Page width is 204 characters at pitch 15.
- Page width is 233 characters at a pitch of 17.
- Page width is 260 characters at a pitch of 20.
- Page length is 88 lines at 8 lines per inch.

Refer to the *P-Series Printer Protocol chapter* in this book for more information. For additional printer flags, review the **qprt** command. You can view more information on the **qprt** command by typing **man qprt** from an AIX command line. You can also obtain information from InfoExplorer.

The code page translation steps are normally done with attributes t0, t1, t2, t3 which point to the code pages, ant c1, c2, c3, c4....which contain the commands to send to the printer to select a code page. In this virtual printer, the character set is based on the "ESC l *xyz"* P-Series Character Set Select command with the IBM PC character set and English (ASCII USA) language selected.

To choose another symbol set, use the AIX (UNIX) **lsvirprt** command to edit the virtual printer and change the et attribute. The values you may specify are a subset of the values for the P–Series Character Set Select command described in Table 4–1, Table 4–2, and Table 4–3 (page 4–17 and following). The defined values you may select for *x*, *y*, and *z* are as follows:

Table B–4. *x* Values for Character Set Select

x Values	Character Set Select
0	IBM PC
1	Multinational
2	ECMA 94 Latin 1
3	DEC Multinational

Table B–5. *y* Values for International Language Select

y Values	x=0	x=1	x=2	x=2
0	ASCII (USA)	ASCII (USA)	ASCII (USA)	ASCII (USA)
1	French	EBCDIC	German	French
2	German	n/a	Swedish	German

Table B–6. *z* Values for International Language Select

z Values	x=0	x=1	x=2	x=3
0	ASCII PC	Multinational	Barcode 10 cpi	DEC Multinational
1	Mult. NLQ 10 cpi	Mult. NLQ 10 cpi	Mult. NLQ 10 cpi	Mult. NLQ 10 cpi

Attaching an AS/400 ASCII Workstation Controller

The ASCII workstation controller provides the ability to attach ASCII printers, such as this printer, through an RS-232 or RS-422 interface. The attached printer may be used with either host–directed printing or host print transform.

Host–Directed Printing

The workstation controller enables support for ASCII printers to emulate an IBM 5224 printer. The ASCII printer appears to the AS/400 as a twinaxial printer. For detailed information, read *IBM AS/400 Printing III*, GC24–4028.

NOTE: When selecting an ASCII printer form an AS/400, make sure you select either an IBM Proprinter III XL or Epson FX-1050 printer, as this printer provides emulation support for the IBM 64XX printers.

Host Print Transform

The Host Print Transform function is available in AS/400 Version 2.0, Release 3.0 and later. This function transforms SCS data stream to to ASCII on the AS/400. The ASCII data stream that is generated is in SCS ASCII Transparency mode (ATRN 03nn). The translated ASCII goes straight to the printer without additional transformation. Below are brief steps that describe how to configure Host Print Transform. For detailed information, read *IBM AS/400 Printing III*, GC24–4028.

Configuring Host Print Transform

For ASCII printers, you need to create or change a printer device description on the AS/400 to use the Host Print Transform.

NOTE: Before you create or change a printer device, you should attach the printer to the workstation controller and then enable AS/400 to auto–configure the printer device. This creates a printer device you can update.

Follow these steps:

1. After you have attached the printer to the ASCII Workstation Controller, enable AS/400 to auto–configure the printer device.

2. End the printer writer and vary off the device. Before making configuration changes, the printer writer must be ended and the device varied off. Enter the following commands on a command line to end the writer and vary off the device:

```
ENDWTR WTR(HPTRT2) OPTION(*IMMED)
VRYCFG CFGOBJ(HPTPRT2) CFGTYPE(*DEV) STATUS(*OFF)
```

3. Change the device description to match this printer. Enter the following commands on a command line to begin changing the device description:

```
CHGDEVPRT HPTPRT2
```

4. From the displayed menu, select the appropriate values for this printer and press Enter to save your choices. (You can press F4 for a selection of supported values you may choose.) Among the choices, here are some suggested values:

   Host Print Transform: *Yes

   Manufacturer type and model: IBM Proprinter III XL

NOTE: When selecting an ASCII printer, make sure you select either an IBM Proprinter III XL or Epson FX-1050 printer, because this printer provides emulation support for the 64XX printers.

5. After you have selected and saved the values you want, you need to vary the device back on. Enter the following command on a command line to vary the device back on:

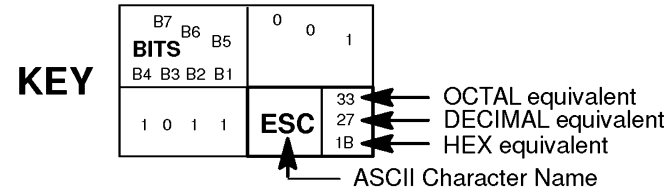
```
VRYCFG CFGOBJ(HPTPRT2) CFGTYPE(*DEV) STATUS(*ON)
```

6. Restart the writer. Enter the following command on a command line to restart the writer.

```
STRPRTWTR WTR(HPTRT2)
```

You can now begin printing with Host Print Transform.

C ASCII Character Set



B7 B6 B5 / BITS B4 B3 B2 B1	ROW	0 0 0 COLUMN 0		0 0 1 1		0 1 0 2		0 1 1 3		1 0 0 4		1 0 1 5		1 1 0 6		1 1 1 7	
0 0 0 0	0	NUL	0 0 0	DLE	20 16 10	SP	40 32 20	0	60 48 30	@	100 64 40	P	120 80 50	`	140 96 60	p	160 112 70
0 0 0 1	1	SOH	1 1 1	DC1 (XON)	21 17 11	!	41 33 21	1	61 49 31	A	101 65 41	Q	121 81 51	a	141 97 61	q	161 113 71
0 0 1 0	2	STX	2 2 2	DC2	22 18 12	"	42 34 22	2	62 50 32	B	102 66 42	R	122 82 52	b	142 98 62	r	162 114 72
0 0 1 1	3	ETX	3 3 3	DC3 (XOFF)	23 19 13	#	43 35 23	3	63 51 33	C	103 67 43	S	123 83 53	c	143 99 63	s	163 115 73
0 1 0 0	4	EOT	4 4 4	DC4	24 20 14	$	44 36 24	4	64 52 34	D	104 68 44	T	124 84 54	d	144 100 64	t	164 116 74
0 1 0 1	5	ENQ	5 5 5	NAK	25 21 15	%	45 37 25	5	65 53 35	E	105 69 45	U	125 85 55	e	145 101 65	u	165 117 75
0 1 1 0	6	ACK	6 6 6	SYN	26 22 16	&	46 38 26	6	66 54 36	F	106 70 46	V	126 86 56	f	146 102 66	v	166 118 76
0 1 1 1	7	BEL	7 7 7	ETB	27 23 17	'	47 39 27	7	67 55 37	G	107 71 47	W	127 87 57	g	147 103 67	w	167 119 77
1 0 0 0	8	BS	10 8 8	CAN	30 24 18	(	50 40 28	8	70 56 38	H	110 72 48	X	130 88 58	h	150 104 68	x	170 120 78
1 0 0 1	9	HT	11 9 9	EM	31 25 19	)	51 41 29	9	71 57 39	I	111 73 49	Y	131 89 59	i	151 105 69	y	171 121 79
1 0 1 0	10	LF	12 10 0 A	SUB	32 26 1A	*	52 42 2A	:	72 58 3A	J	112 74 4A	Z	132 90 5A	j	152 106 6A	z	172 122 7A
1 0 1 1	11	VT	13 11 0 B	ESC	33 27 1B	+	53 43 2B	;	73 59 3B	K	113 75 4B	[	133 91 5B	k	153 107 6B	{	173 123 7B
1 1 0 0	12	FF	14 12 0 C	FS	34 28 1C	,	54 44 2C	<	74 60 3C	L	114 76 4C	\	134 92 5C	l	154 108 6C	|	174 124 7C
1 1 0 1	13	CR	15 13 0 D	GS	35 29 1D	–	55 45 2D	=	75 61 3D	M	115 77 4D	]	135 93 5D	m	155 109 6D	}	175 125 7D
1 1 1 0	14	SO	16 14 0 E	RS	36 30 1E	.	56 46 2E	>	76 62 3E	N	116 78 4E	^	136 94 5E	n	156 110 6E	~	176 126 7E
1 1 1 1	15	SI	17 15 0 F	US	37 31 1F	/	57 47 2F	?	77 63 3F	O	117 79 4F	_	137 95 5F	o	157 111 6F	DEL	177 127 7F

D Proprinter III XL Character Sets

Chapter Contents

Overview

This appendix shows the character set charts (also referred to as code pages) for the Proprinter III XL emulation. The character sets shown in this appendix may be selected using the configuration menus, described in detail in Chapter 4 of the *Setup Guide*.

Each Proprinter III XL character set is shown printed in at least one of the following modes that can be selected from the operator panel:

- NLQ Serif (also called simply NLQ)
- NLQ Sans Serif (selected from operator panel or via ESC I)
- Draft 12 CPI (default draft mode for most CPI settings)
- Draft 10 CPI (for some character sets, additional characters will print at 10 CPI and 5 CPI only)

DP mode is not shown in this appendix, because the set of characters that print in DP mode always matches the characters that print in NLQ (Serif quality).

Where the set of characters that can print is identical for each of the modes listed above, only NLQ Serif is shown. If there is varying character set support for NLQ Sans Serif, 10 CPI Draft, and 12 CPI draft, a printout in each differing mode is shown.

The maximum set of printable symbols is shown for columns 80–9F (selected via the ESC 6 control code). For code pages 0437 and 0850, the Print All Characters (ESC \) control code has been used to show a full set of printable symbols for columns 00–1F.

Print Modes Supported for Character Sets

Following is a summary of which print modes are supported for each of the Proprinter III XL character sets. An "X" indicates support for a print mode. Additional information about character set support is provided under the heading "Notes."

Table D–1. Print Modes Supported

Character Set	NLQ (Serif)	DP	Draft	Notes
0437 PC Character Set	X	X	X	
0813 Greek	X	X	X	Partial character set supported in Draft mode.
0819 ISO/ANSI Multilingual	X	X	X	
0850 PC Multilingual	X	X	X	
0851 Greek Old	X	X	X	
0852 Latin 2/Roece	X	X	X	
0853 Latin 3 PC	X	X	X	
0855 Cyrillic	X	X	X	Partial character set support in Draft mode.
0857 Turkish	X	X	X	
0860 Portuguese	X	X	X	
0861 Icelandic	X	X	X	
0862 Hebrew	X	X	X	
0863 Canadian French	X	X	X	
0864 Arabic	X	X	X	Full character set support in Draft mode for 5 and 10 CPI only. Partial support in NLQ Sans Serif mode.
0865 Danish/Norwegian	X	X	X	
0866 Russian Cyrillic 996	X	X	X	Partial character set support in Draft mode.
0869 Greek New	X	X	X	
0874 Thai	X	X	X	Partial character set support in Draft mode and NLQ Sans Serif mode.

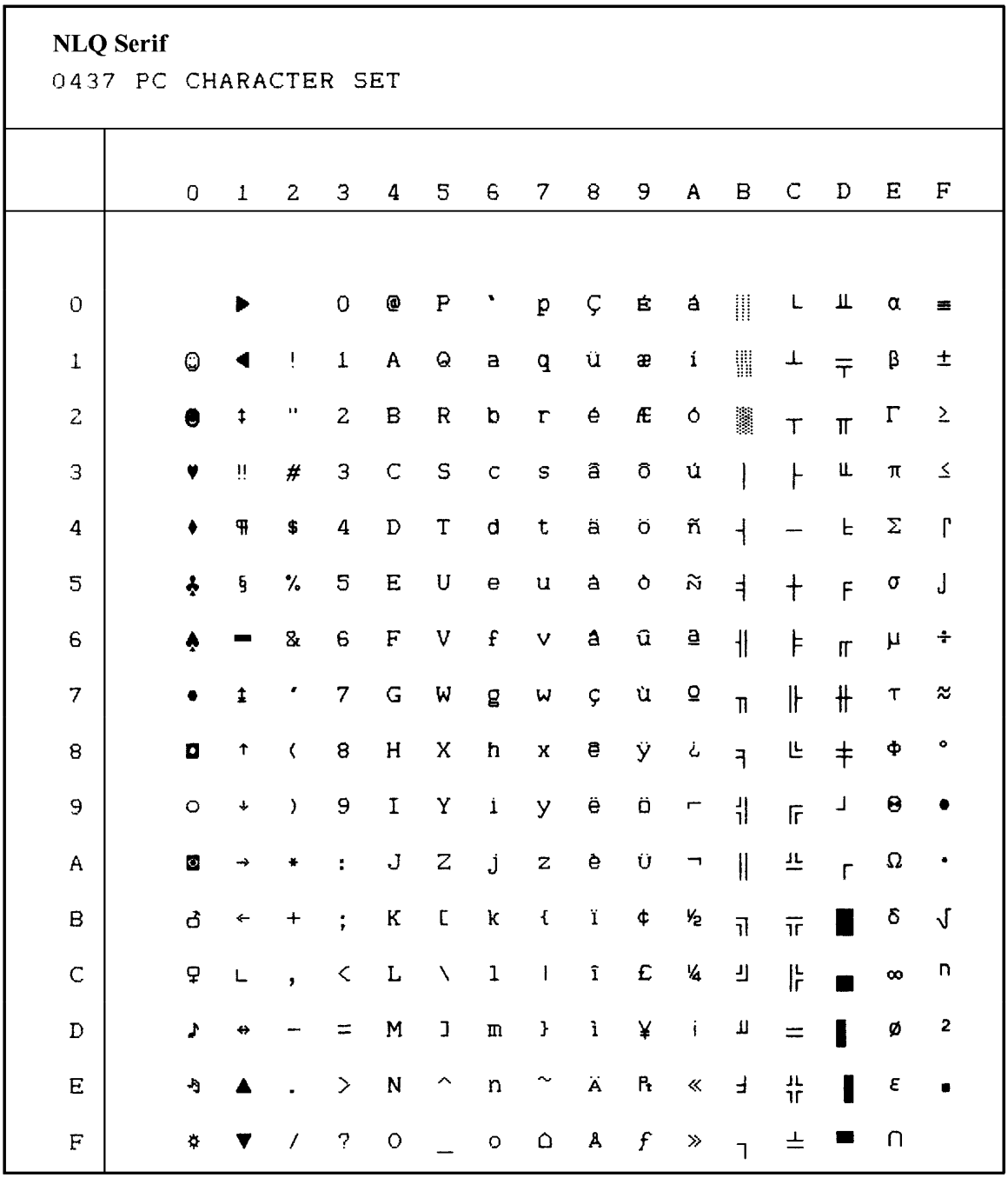
(continued next page)

Table D–1. Print Modes Supported *(continued)*

Character Set	NLQ (Serif)	DP	Draft	Notes
0876 OCR A	N/A	N/A	N/A	10 CPI OCR only
0877 OCR B	N/A	N/A	N/A	10 CPI OCR only
0912 ISO Latin 2 PC	X	X	X	
0915 ISO Cyrillic PC	X	X	X	Partial character set support in Draft mode.
1046 Arabic Extended	X	X	X	Full character set support in Draft mode for 5 and 10 CPI only. Partial support in NLQ Sans Serif mode.
1098 Farsi 1285 (PC)	X	X	X	Full character set support in Draft mode for 5 and 10 CPI only. Partial support in NLQ Sans Serif mode.

NLQ Serif

0437 PC CHARACTER SET



	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0		▶		0	@	P	`	p	Ç	É	á	▒	└	╨	α	≡
1	☺	◀	!	1	A	Q	a	q	ü	æ	í	▒	┴	╤	β	±
2	☻	↕	"	2	B	R	b	r	é	Æ	ó	▓	┬	╥	Γ	≥
3	♥	‼	#	3	C	S	c	s	â	ô	ú	│	├	╙	π	≤
4	♦	¶	$	4	D	T	d	t	ä	ö	ñ	┤	─	╘	Σ	⌠
5	♣	§	%	5	E	U	e	u	à	ò	Ñ	╡	┼	╒	σ	⌡
6	♠	▬	&	6	F	V	f	v	å	û	ª	╢	╞	╓	µ	÷
7	•	↨	'	7	G	W	g	w	ç	ù	º	╖	╟	╫	τ	≈
8	◘	↑	(	8	H	X	h	x	ê	ÿ	¿	╕	╚	╪	Φ	°
9	○	↓	)	9	I	Y	i	y	ë	Ö	⌐	╣	╔	┘	Θ	∙
A	◙	→	*	:	J	Z	j	z	è	Ü	¬	║	╩	┌	Ω	·
B	♂	←	+	;	K	[	k	{	ï	¢	½	╗	╦	█	δ	√
C	♀	∟	,	<	L	\	l	|	î	£	¼	╝	╠	▄	∞	n
D	♪	↔	-	=	M	]	m	}	ì	¥	¡	╜	═	▌	ø	2
E	♫	▲	.	>	N	^	n	~	Ä	₧	«	╛	╬	▐	ε	■
F	☼	▼	/	?	O	_	o	⌂	Å	ƒ	»	┐	╧	▀	∩	

NLQ Serif
0813 GREEK

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0				0	@	P	`	p				°	ΐ	Π	ϋ	π
1			!	1	A	Q	a	q			΄	±	A	P	α	ρ
2			"	2	B	R	b	r			΅	²	B		β	ς
3			#	3	C	S	c	s			£	³	Γ	Σ	γ	σ
4			$	4	D	T	d	t				´	Δ	T	δ	τ
5			%	5	E	U	e	u				Μ	E	Υ	ε	υ
6			&	6	F	V	f	v			¦	Ά	Z	Φ	ζ	φ
7			'	7	G	W	g	w			§	·	H	X	η	χ
8			(	8	H	X	h	x			¨	Έ	Θ	Ψ	θ	ψ
9			)	9	I	Y	i	y			©	Η	I	Ω	ι	ω
A			*	:	J	Z	j	z				Ί	K	Ϊ	κ	ϊ
B			+	;	K	[	k	{			«	»	Λ	ΰ	λ	ϋ
C			,	<	L	\	l	|			¬	Ό	M	ά	μ	ό
D			-	=	M	]	m	}				½	N	έ	ν	ύ
E			.	>	N	^	n	~				Ύ	Ξ	ή	ξ	ώ
F			/	?	O	_	o				―	Ώ	O	ί	ο	

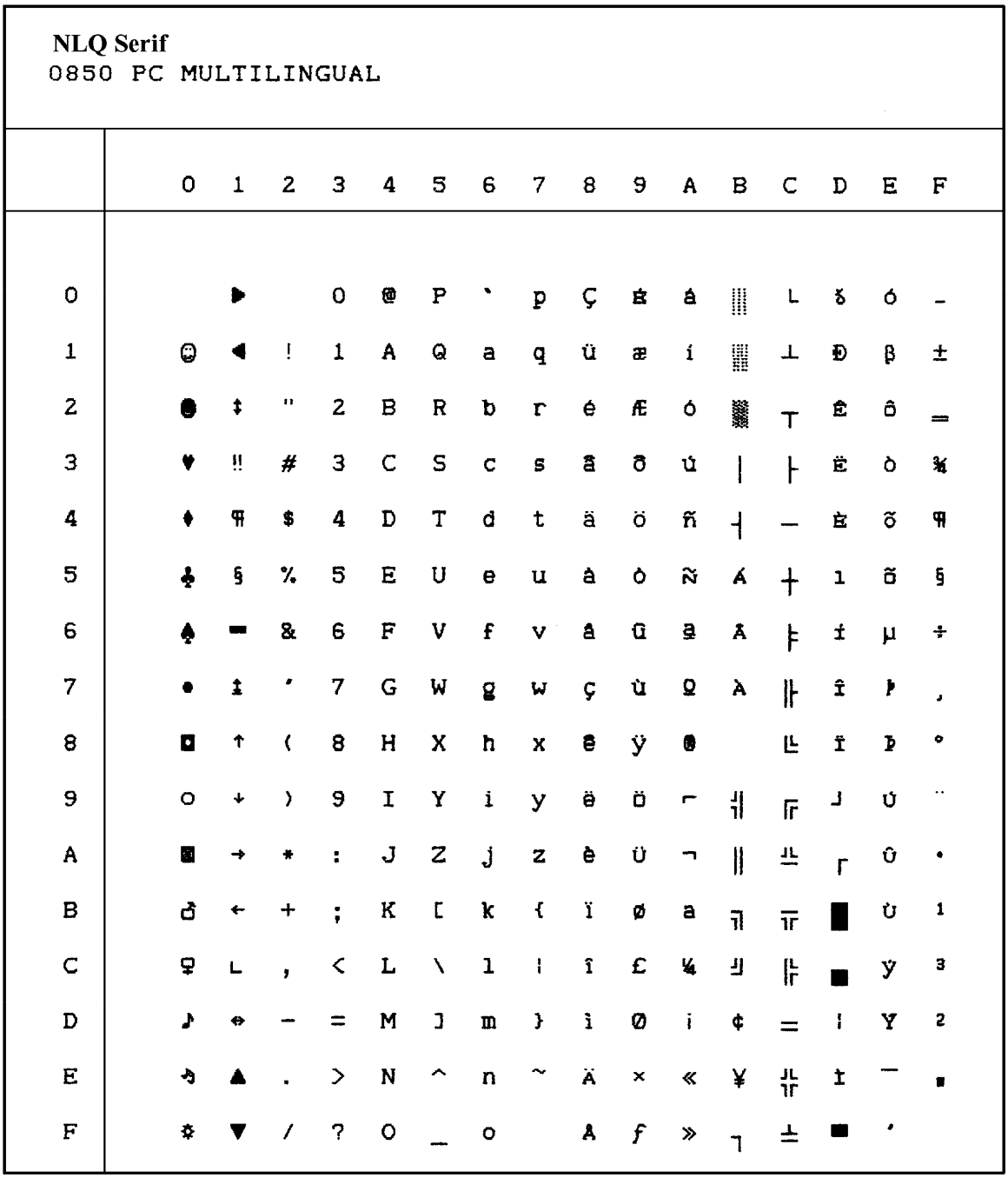
DRAFT 10 CPI
0813 GREEK

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0				0	@	P	`	p				°	ΐ	Π	ϋ	π
1			!	1	A	Q	a	q			΄	±	Α	Ρ	ά	ρ
2			"	2	B	R	b	r			΅	²	Β		έ	ς
3			#	3	C	S	c	s			£	³	Γ	Σ	ή	σ
4			$	4	D	T	d	t				΄	Δ	Τ	ί	τ
5			%	5	E	U	e	u					Ε	Υ	ΰ	υ
6			&	6	F	V	f	v			¦	Ά	Ζ	Φ	α	φ
7			'	7	G	W	g	w			§	·	Η	Χ	β	χ
8			(	8	H	X	h	x			¨	Έ	Θ	Ψ	γ	ψ
9			)	9	I	Y	i	y			©	Ή	Ι	Ω	δ	ω
A			*	:	J	Z	j	z				Ί	Κ	Ϊ	ε	ΐ
B			+	;	K	[	k	{			«	Ύ	Λ		ζ	ΰ
C			,	<	L	\	l	|			¬	Ό	Μ	ά	η	ό
D			-	=	M	]	m	}				½	Ν	έ	θ	ύ
E			.	>	N	^	n	~				Ύ	Ξ	ή	ξ	ώ
F			/	?	O	_	o				―	Ώ	Ο	ί	ο	

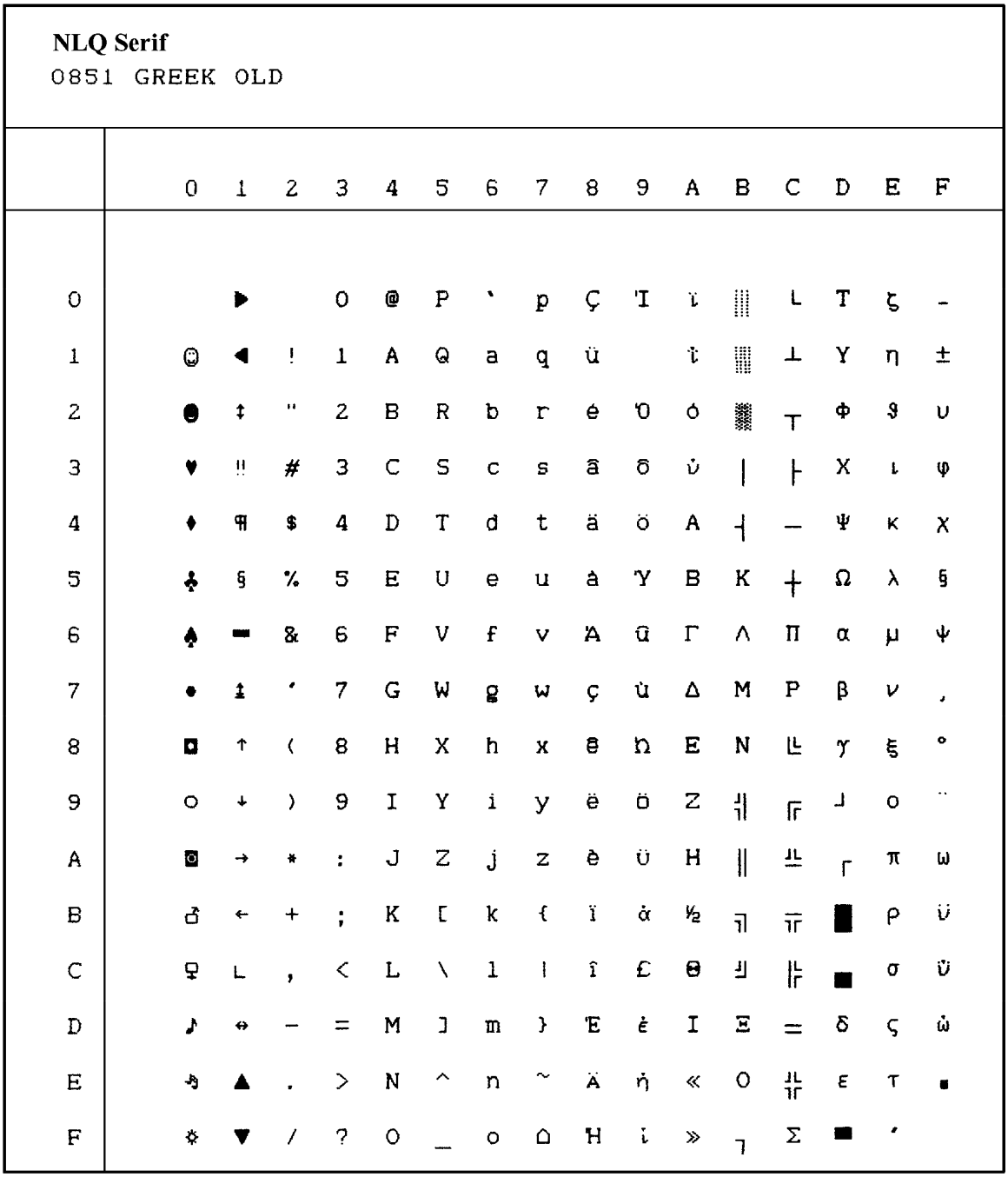
NLQ Serif
0819 ISO/ANSI MULTILINGUAL

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0				0	@	P	`	p				°	À	Ð	à	ð
1			!	1	A	Q	a	q			¡	±	Á	Ñ	á	ñ
2			"	2	B	R	b	r			¢	²	Â	Ò	â	ò
3			#	3	C	S	c	s			£	³	Ã	Ó	ã	ó
4			$	4	D	T	d	t			¤	´	Ä	Ô	ä	õ
5			%	5	E	U	e	u			¥	µ	Å	Õ	å	õ
6			&	6	F	V	f	v			¦	¶	Æ	Ö	æ	ö
7			'	7	G	W	g	w			§	·	Ç	×	ç	÷
8			(	8	H	X	h	x			¨	¸	È	Ø	è	ø
9			)	9	I	Y	i	y			©	¹	É	Ù	é	ù
A			*	:	J	Z	j	z			ª	º	Ê	Ú	ê	ú
B			+	;	K	[	k	{			«	»	Ë	Û	ë	û
C			,	<	L	\	l	|			¬	¼	Ì	Ü	ì	ü
D			-	=	M	]	m	}				½	Í	Ý	í	ý
E			.	>	N	^	n	~			®	¾	Î	Þ	î	þ
F			/	?	O	_	o				¯	¿	Ï	ß	ï	ÿ

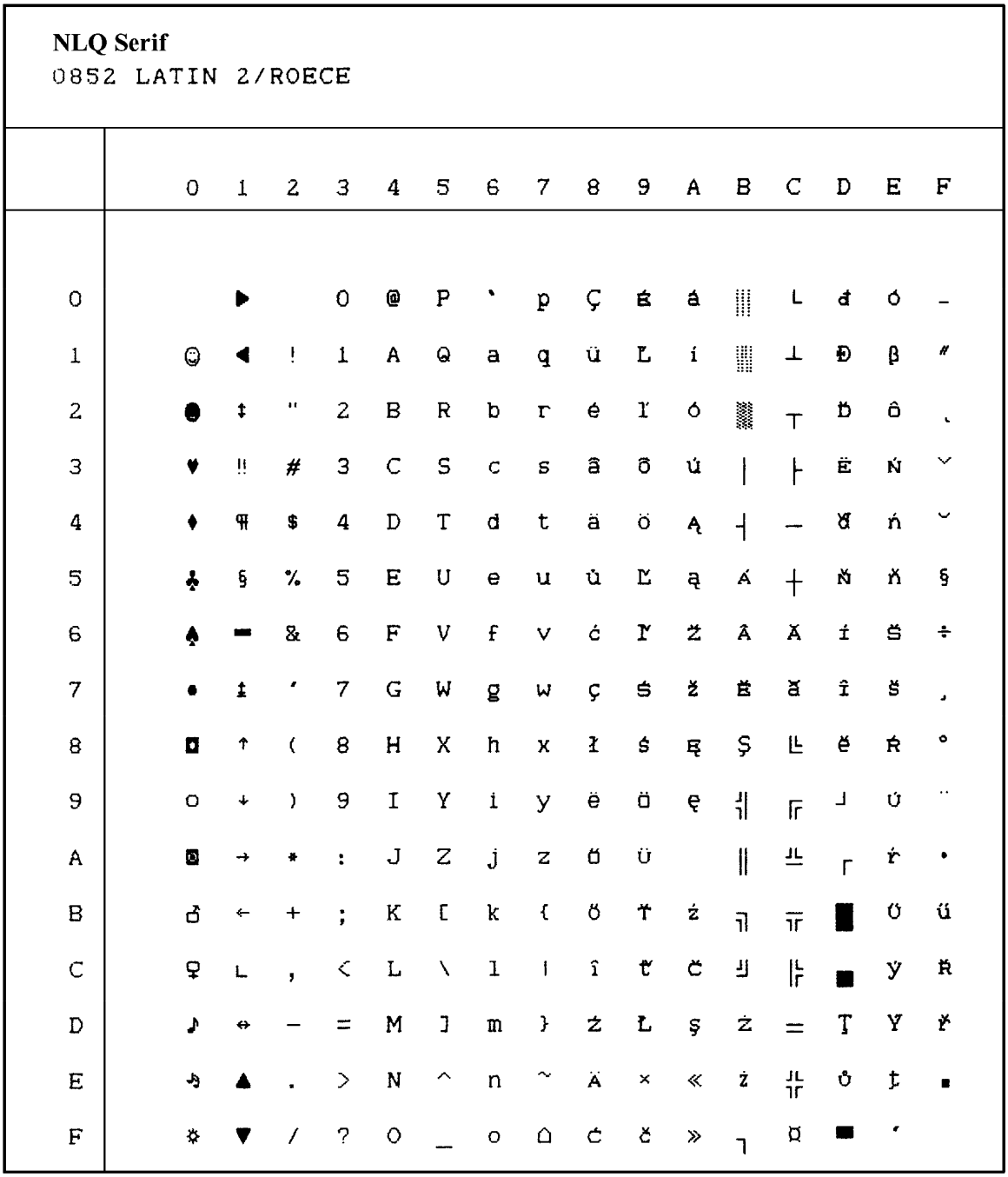
NLQ Serif
0850 PC MULTILINGUAL



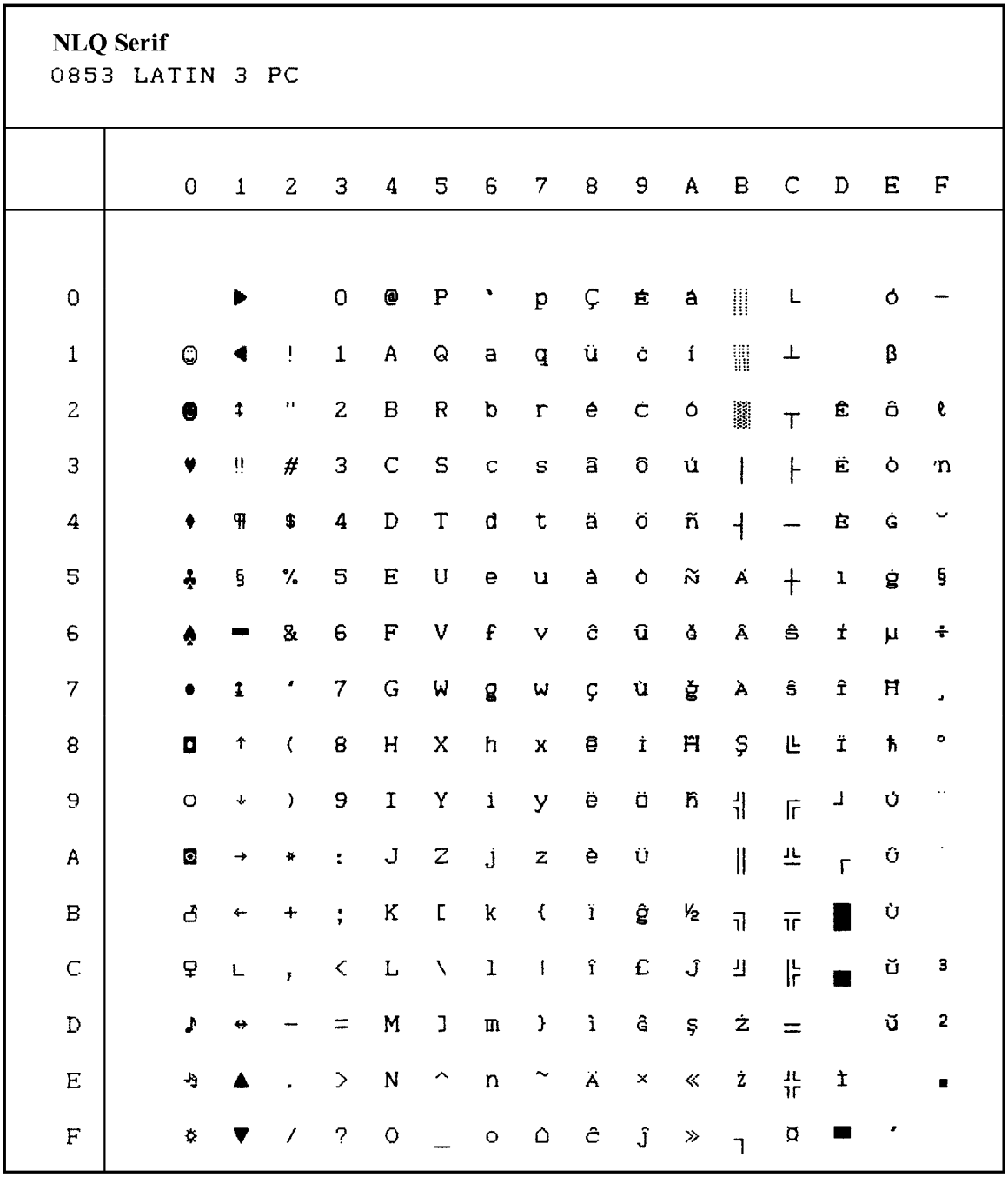
NLQ Serif
0851 GREEK OLD



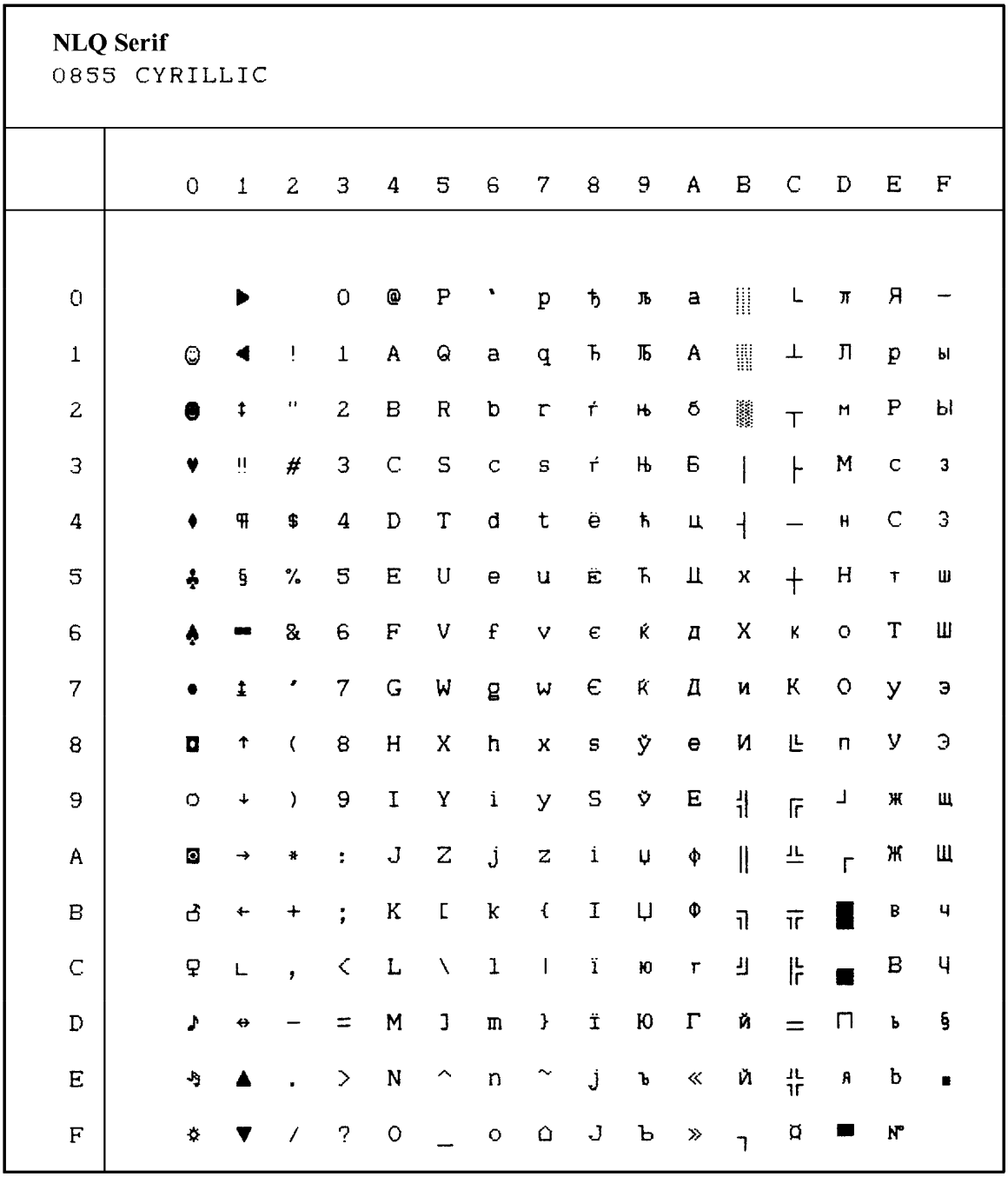
NLQ Serif
0852 LATIN 2/ROECE



NLQ Serif
0853 LATIN 3 PC

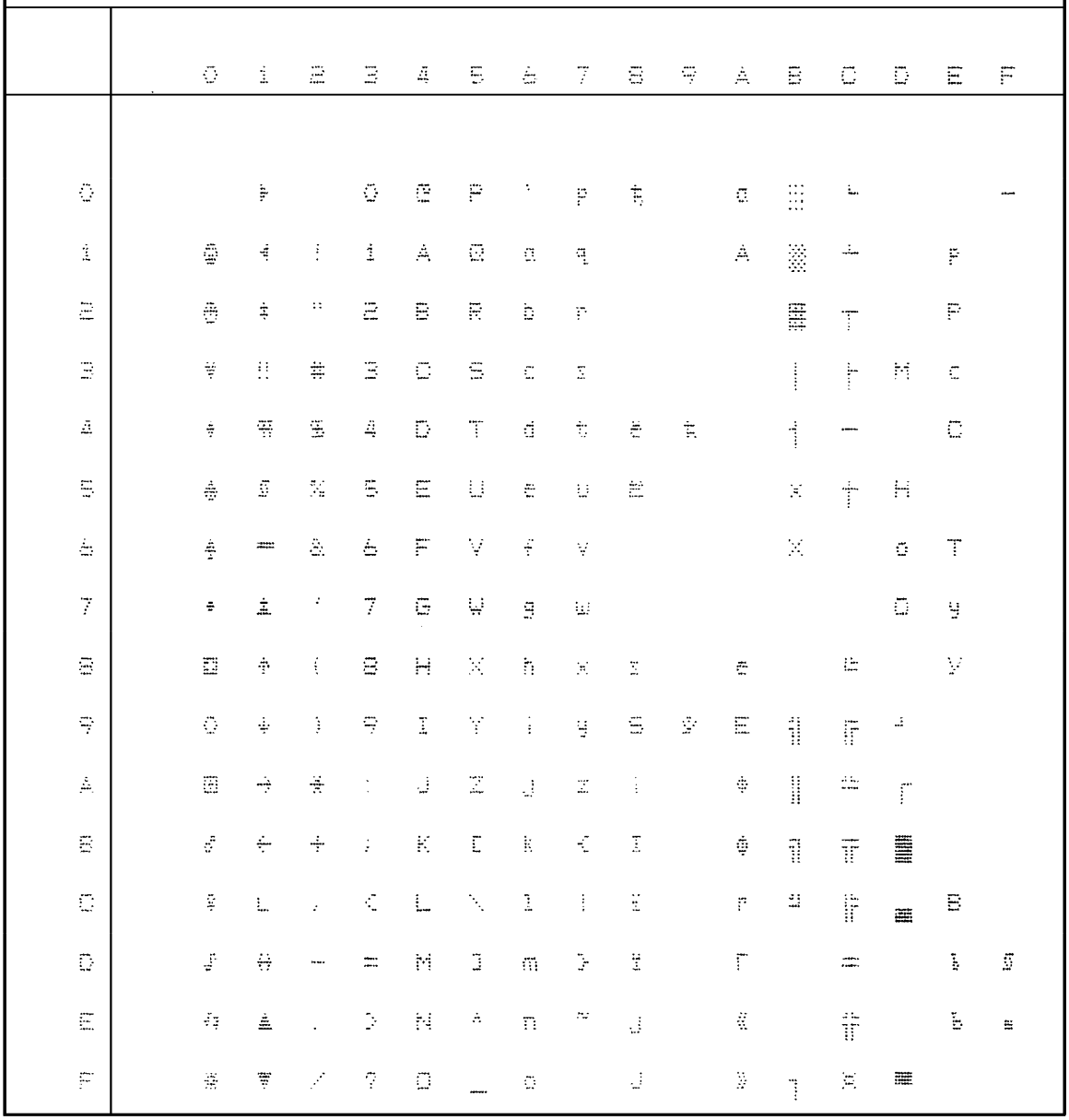


NLQ Serif
0855 CYRILLIC



DRAFT 10 CPI

0855 CYRILLIC



NLQ Serif

0857 TURKISH

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0		►		0	@	P	`	p	Ç	É	á	░	└	º	Ó	-
1	☺	◄	!	1	A	Q	a	q	ü	æ	í	▒	┴	ª	ß	±
2	☻	↕	"	2	B	R	b	r	é	Æ	ó	▓	┬	Ê	Ô	
3	♥	‼	#	3	C	S	c	s	â	ô	ú	│	├	Ë	Ò	¾
4	♦	¶	$	4	D	T	d	t	ä	ö	ñ	┤	─	È	õ	¶
5	♣	§	%	5	E	U	e	u	à	ò	Ñ	Á	┼		Õ	§
6	♠	▬	&	6	F	V	f	v	å	û	Ğ	Â	ã	Í	µ	÷
7	•	↨	'	7	G	W	g	w	ç	ù	ğ	À	Ã	Î		¸
8	◘	↑	(	8	H	X	h	x	ê	İ	¿	©	╚	Ï	×	°
9	○	↓	)	9	I	Y	i	y	ë	Ö	®	╣	╔	┘	Ú	¨
A	◙	→	*	:	J	Z	j	z	è	Ü	¬	║	╩	┌	Û	·
B	♂	←	+	;	K	[	k	{	ï	ø	½	╗	╦	█	Ù	¹
C	♀	∟	,	<	L	\	l	|	î	£	¼	╝	╠	▄	ì	³
D	♪	↔	-	=	M	]	m	}	ı	Ø	¡	¢	═	¦	ÿ	²
E	♫	▲	.	>	N	^	n	~	Ä	Ş	«	¥	╬	Ì	¯	■
F	☼	▼	/	?	O	_	o	⌂	Å	ş	»	┐	¤	▀	´	

NLQ Serif

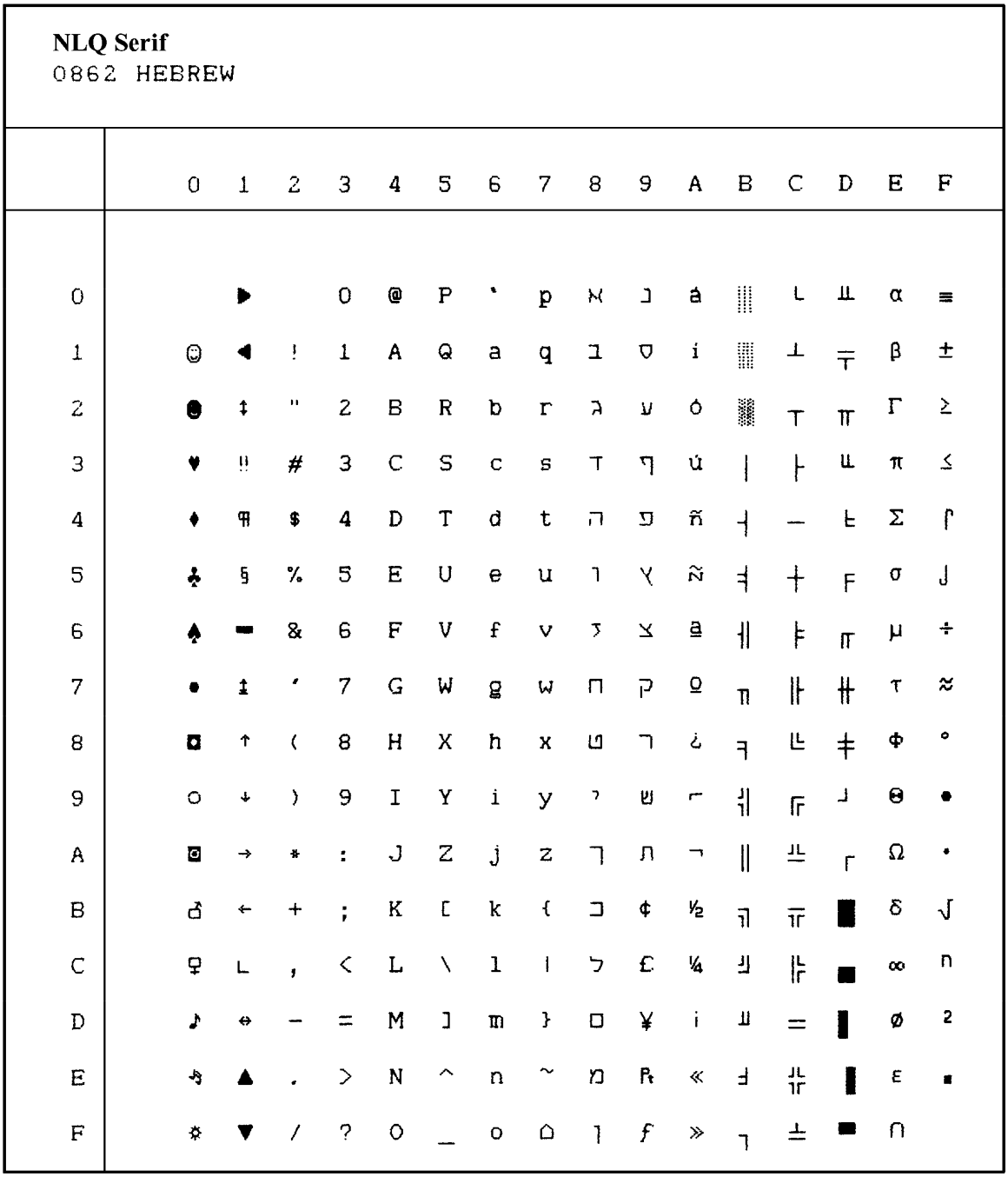
0860 PORTUGUESE

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0		▶		0	@	P	`	p	Ç	É	á	▒	└	╨	α	≡
1	☺	◀	!	1	A	Q	a	q	ü	À	í	▒	┴	╤	β	±
2	☻	↕	"	2	B	R	b	r	é	È	ó	▓	┬	╥	Γ	≥
3	♥	‼	#	3	C	S	c	s	â	õ	ú	│	├	╙	π	≤
4	♦	¶	$	4	D	T	d	t	ã	ô	ñ	┤	─	╘	Σ	⌠
5	♣	§	%	5	E	U	e	u	à	ò	Ñ	╡	┼	╒	σ	⌡
6	♠	▬	&	6	F	V	f	v	Á	Ú	ª	╢	╞	╓	µ	÷
7	•	↨	'	7	G	W	g	w	ç	ù	º	╖	╟	╫	τ	≈
8	◘	↑	(	8	H	X	h	x	ê	ÿ	¿	╕	╚	╪	Φ	°
9	○	↓	)	9	I	Y	i	y	Ê	Õ	⌐	╣	╔	┘	Θ	∙
A	◙	→	*	:	J	Z	j	z	è	Ü	¬	║	╩	┌	Ω	·
B	♂	←	+	;	K	[	k	{	í	¢	½	╗	╦	█	δ	√
C	♀	∟	,	<	L	\	l	|	ô	£	¼	╝	╠	▄	∞	n
D	♪	↔	-	=	M	]	m	}	ì	Ù	¡	╜	═	▌	ø	²
E	♫	▲	.	>	N	^	n	~	Ã	₧	«	╛	╬	▐	ε	■
F	☼	▼	/	?	O	_	o	⌂	Â	ó	»	┐	╧	▀	∩	

NLQ Serif
0861 ICELANDIC

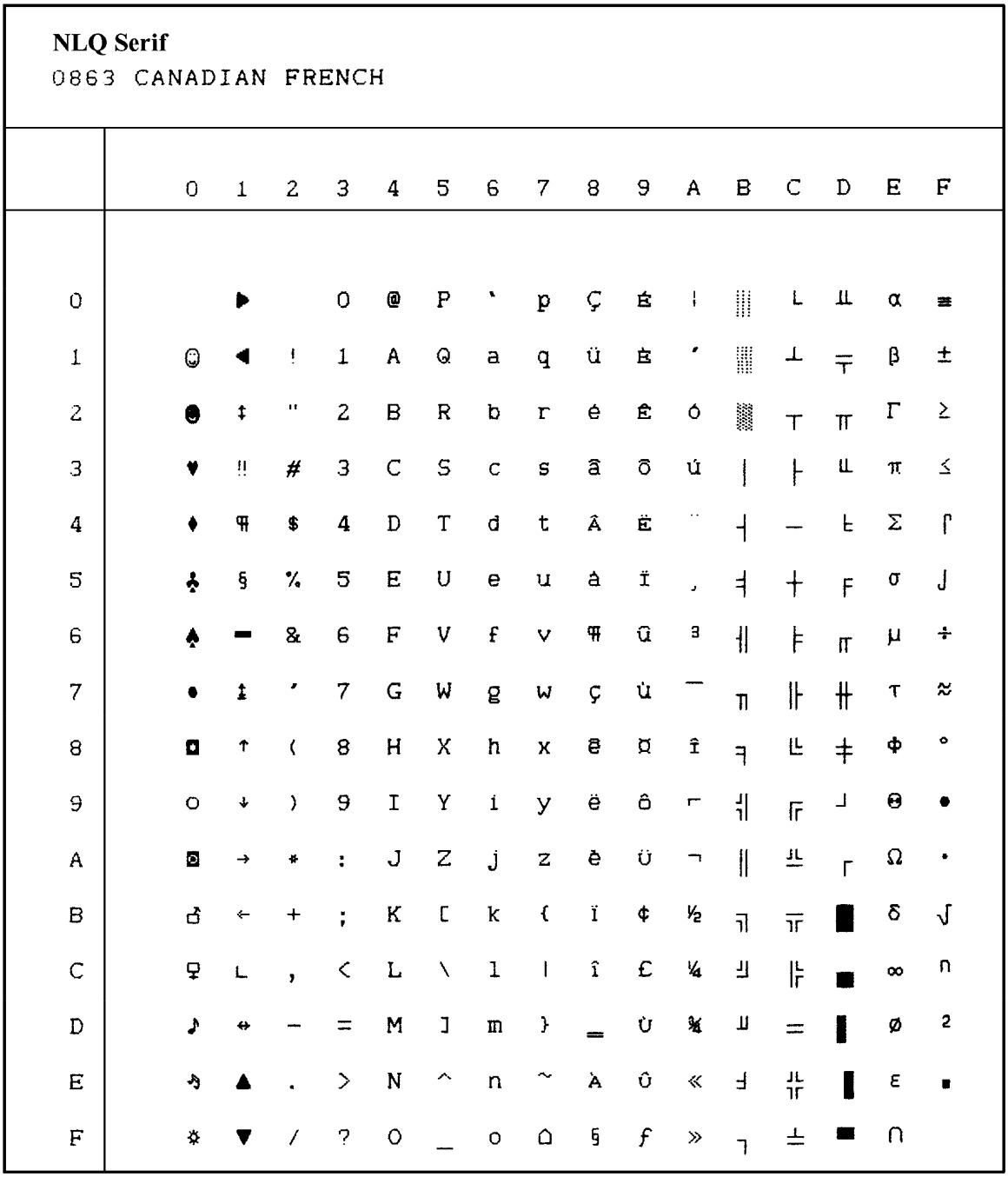
	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0		▶		0	@	P	`	p	Ç	É	á	▒	└	╨	α	≡
1	☺	◀	!	1	A	Q	a	q	ü	æ	í	▒	┴	╤	β	±
2	☻	↕	"	2	B	R	b	r	é	Æ	ó	▓	┬	╥	Γ	≥
3	♥	‼	#	3	C	S	c	s	â	õ	ú	│	├	╙	π	≤
4	♦	¶	$	4	D	T	d	t	ä	ö	Á	┤	─	╘	Σ	⌠
5	♣	§	%	5	E	U	e	u	à	Ƥ	í	╡	┼	╒	σ	⌡
6	♠	▬	&	6	F	V	f	v	ã	ũ	ó	╢	╞	╓	µ	÷
7	•	↨	'	7	G	W	g	w	ç	Ỹ	ú	╖	╟	╫	τ	≈
8	◘	↑	(	8	H	X	h	x	ê	ỹ	¿	╕	╚	╪	Φ	°
9	○	↓	)	9	I	Y	i	y	ë	Õ	⌐	╣	╔	┘	Θ	∙
A	◙	→	*	:	J	Z	j	z	è	Ü	¬	║	╩	┌	Ω	·
B	♂	←	+	;	K	[	k	{	Ð	ø	½	╗	╦	█	δ	√
C	♀	∟	,	<	L	\	l	|	ð	£	¼	╝	╠	∞	n
D	♪	↔	-	=	M	]	m	}	Þ	Ø	¡	╜	═	▌	ø	²
E	♫	▲	.	>	N	^	n	~	Ä	₧	«	╛	╬	▐	ε	■
F	☼	▼	/	?	O	_	o	⌂	Å	ƒ	»	┐	╧	▀	∩	

NLQ Serif
0862 HEBREW



	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0		▶		0	@	P	`	p	א	ך	á	▒	└	╙	α	≡
1	☺	◀	!	1	A	Q	a	q	ך	ט	í	▒	┴	╤	β	±
2	☻	↕	"	2	B	R	b	r	ג	ע	ó	▓	┬	╥	Γ	≥
3	♥	‼	#	3	C	S	c	s	ד	ף	ú	│	├	╙	π	≤
4	♦	¶	$	4	D	T	d	t	ה	פ	ñ	┤	─	╘	Σ	⌠
5	♣	§	%	5	E	U	e	u	ו	ץ	Ñ	╡	┼	╒	σ	⌡
6	♠	▬	&	6	F	V	f	v	ז	צ	ª	╢	╞	╓	µ	÷
7	•	↨	'	7	G	W	g	w	ח	ק	º	╖	╟	╫	τ	≈
8	◘	↑	(	8	H	X	h	x	ט	ר	¿	╕	╚	╪	Φ	°
9	○	↓	)	9	I	Y	i	y	י	ש	⌐	╣	╔	┘	Θ	∙
A	◙	→	*	:	J	Z	j	z	ך	ת	¬	║	╩	┌	Ω	·
B	♂	←	+	;	K	[	k	{	כ	¢	½	╗	╦	█	δ	√
C	♀	∟	,	<	L	\	l	|	ל	£	¼	╝	╠	▄	∞	n
D	♪	↔	-	=	M	]	m	}	ם	¥	¡	╜	═	▌	ø	²
E	♫	▲	.	>	N	^	n	~	מ	₧	«	╛	╬	▐	ε	■
F	☼	▼	/	?	O	_	o	⌂	ן	ƒ	»	┐	╧	▀	∩	

NLQ Serif
0863 CANADIAN FRENCH

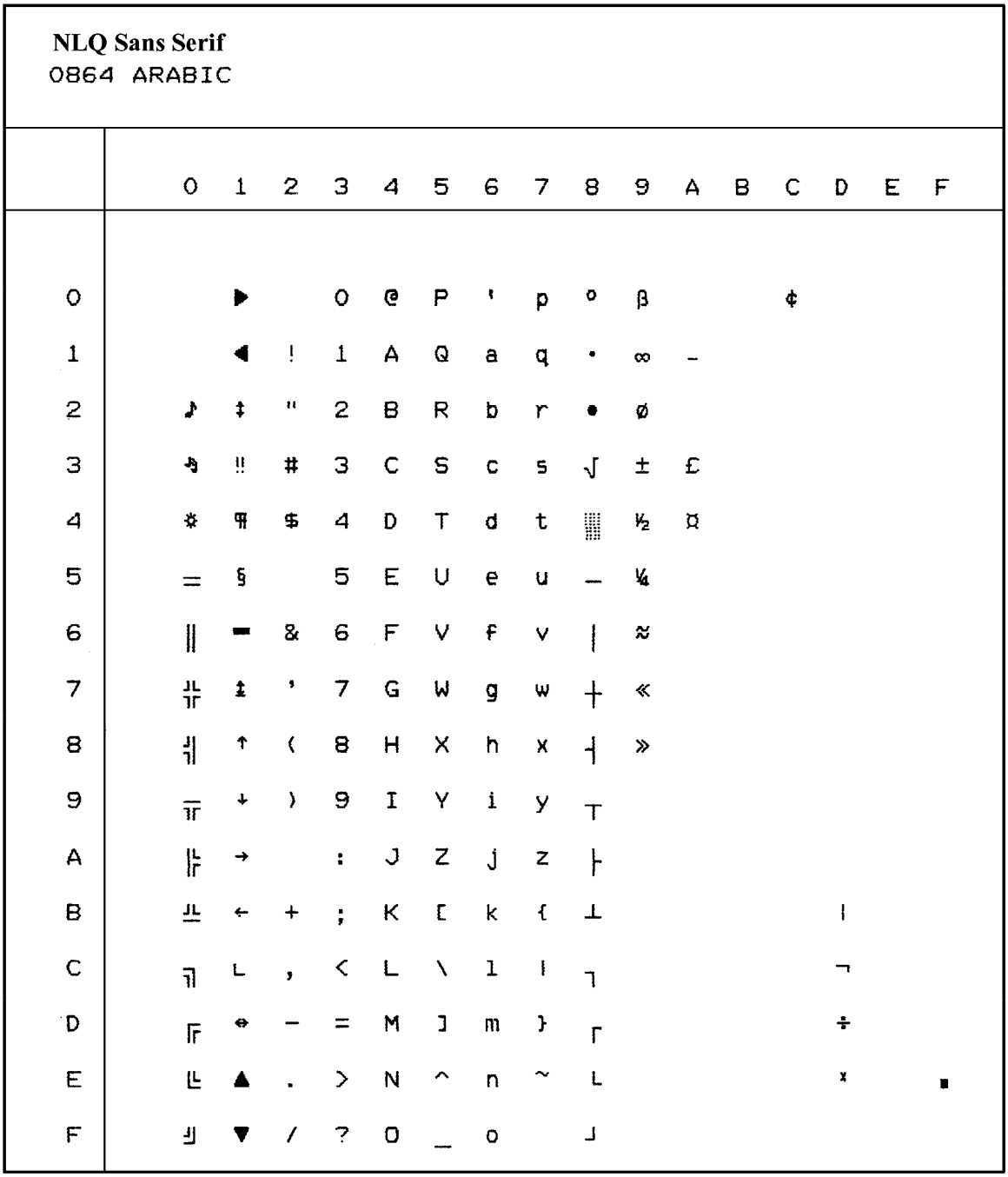


NLQ Serif

0864 ARABIC

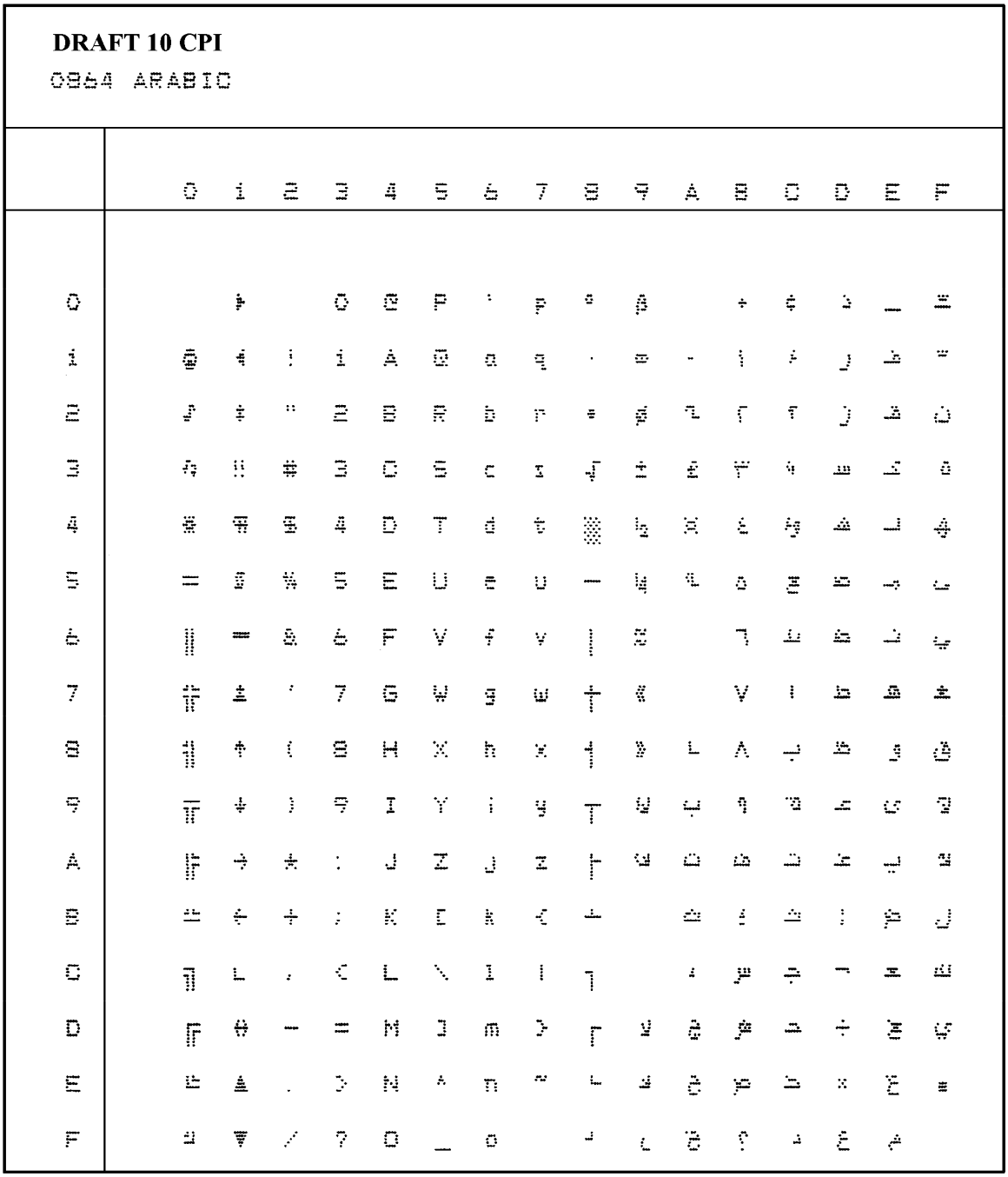
	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0		▶		0	@	P	`	p	°	β		٠	¢	ذ	ـ	ّ
1	☺	◀	!	1	A	Q	a	q	•	∞	ـ	ا	ء	ر	ف	ٌ
2	♪	↕	"	2	B	R	b	r	●	ø	٢	٢	آ	ز	ق	ن
3	♫	‼	#	3	C	S	c	s	√	±	£	٣	٩	س	ك	ه
4	✲	¶	$	4	D	T	d	t	▒	½	¤	٤	و	ش	ل	ﻫ
5	⚌	§	٪	5	E	U	e	u	⎯	¼	٦	٥	ع	ص	م	ى
6	▒	▬	&	6	F	V	f	v	|	≈		٦	ك	ض	ن	ي
7	╝	↨	'	7	G	W	g	w	┼	«		٧	ا	ط	ھ	غ
8	╣	↑	(	8	H	X	h	x	┤	»	ـ	٨	ب	ظ	و	ق
9	╗	↓	)	9	I	Y	i	y	┬	لا	ب	٩	ة	ع	ى	لآ
A	╠	→	*	:	J	Z	j	z	├	لأ	ت	ف	ت	غ	ب	لآ
B	╩	←	+	;	K	[	k	{	┴		ث	ء	ث	ا	ض	ل
C	╦	∟	,	<	L	\	l	|	┐		ء	س	ج	¬	ھ	ك
D	╔	↔	-	=	M	]	m	}	┌	لا	ج	ش	ح	÷	غ	ى
E	╨	▲	.	>	N	^	n	~	└	لا	ع	ص	خ	×	غ	■
F	╧	▼	/	?	O	_	o		┘	ے	غ	؟	د	ع	م	

NLQ Sans Serif
0864 ARABIC



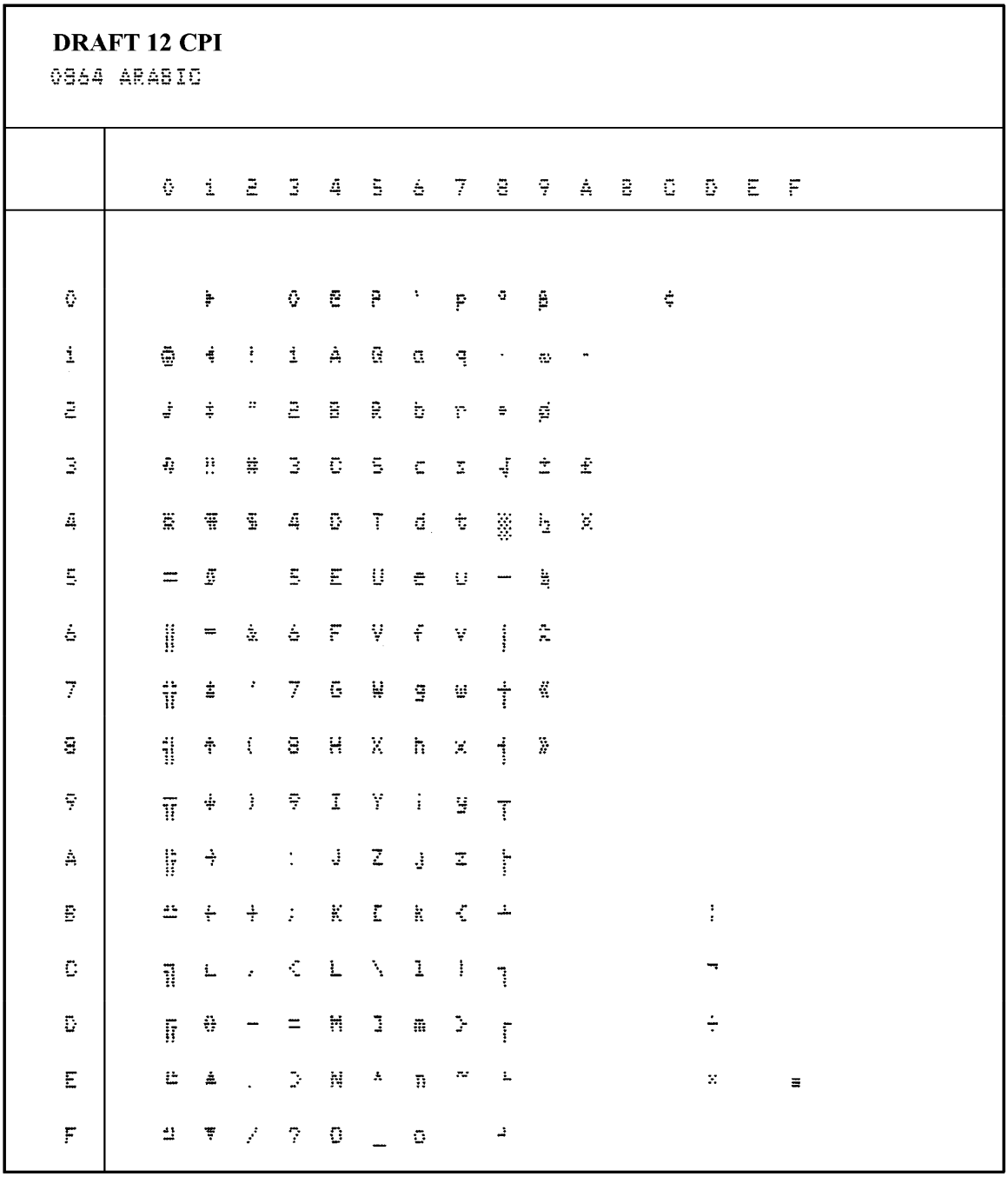
DRAFT 10 CPI

0864 ARABIC

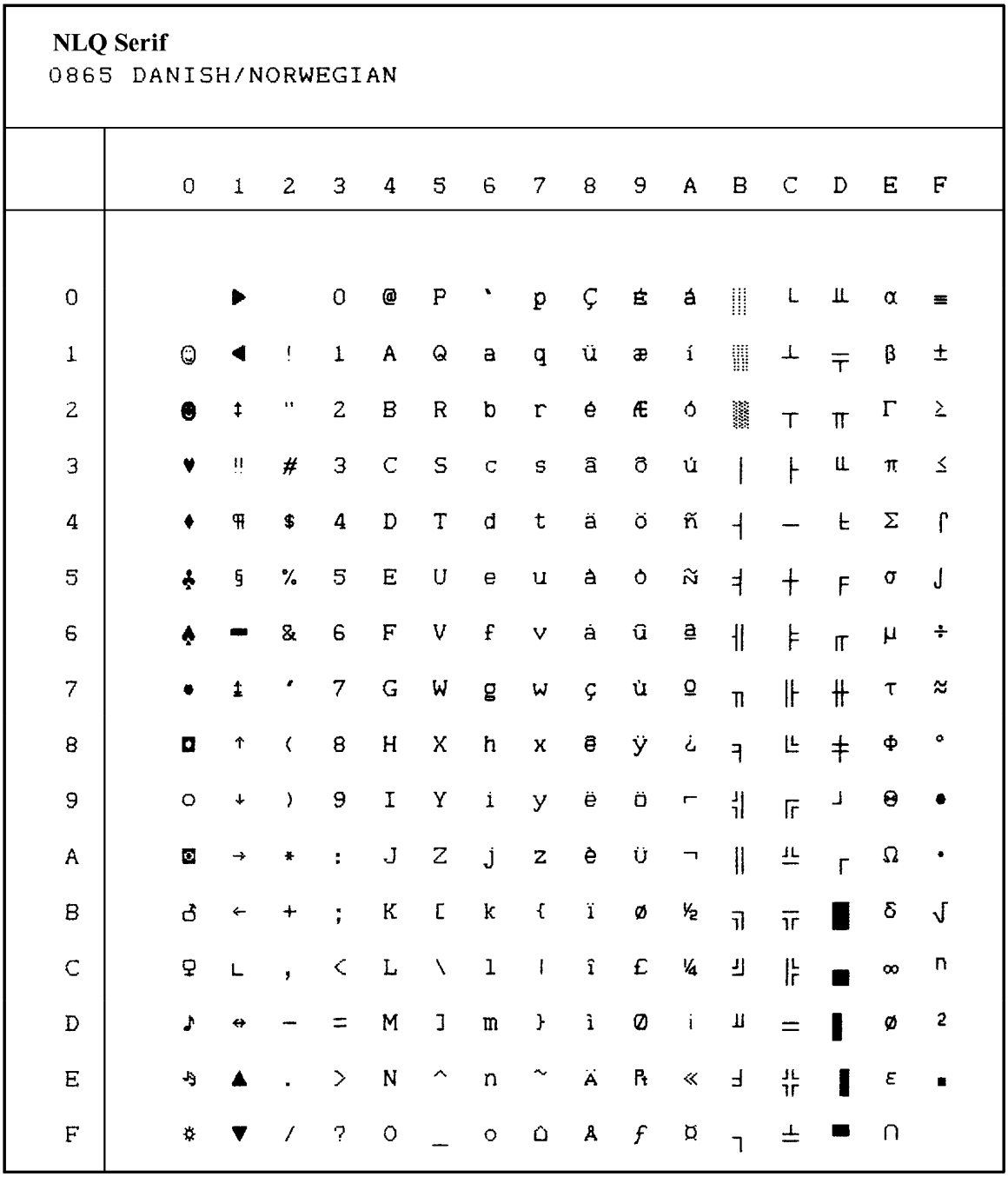


DRAFT 12 CPI

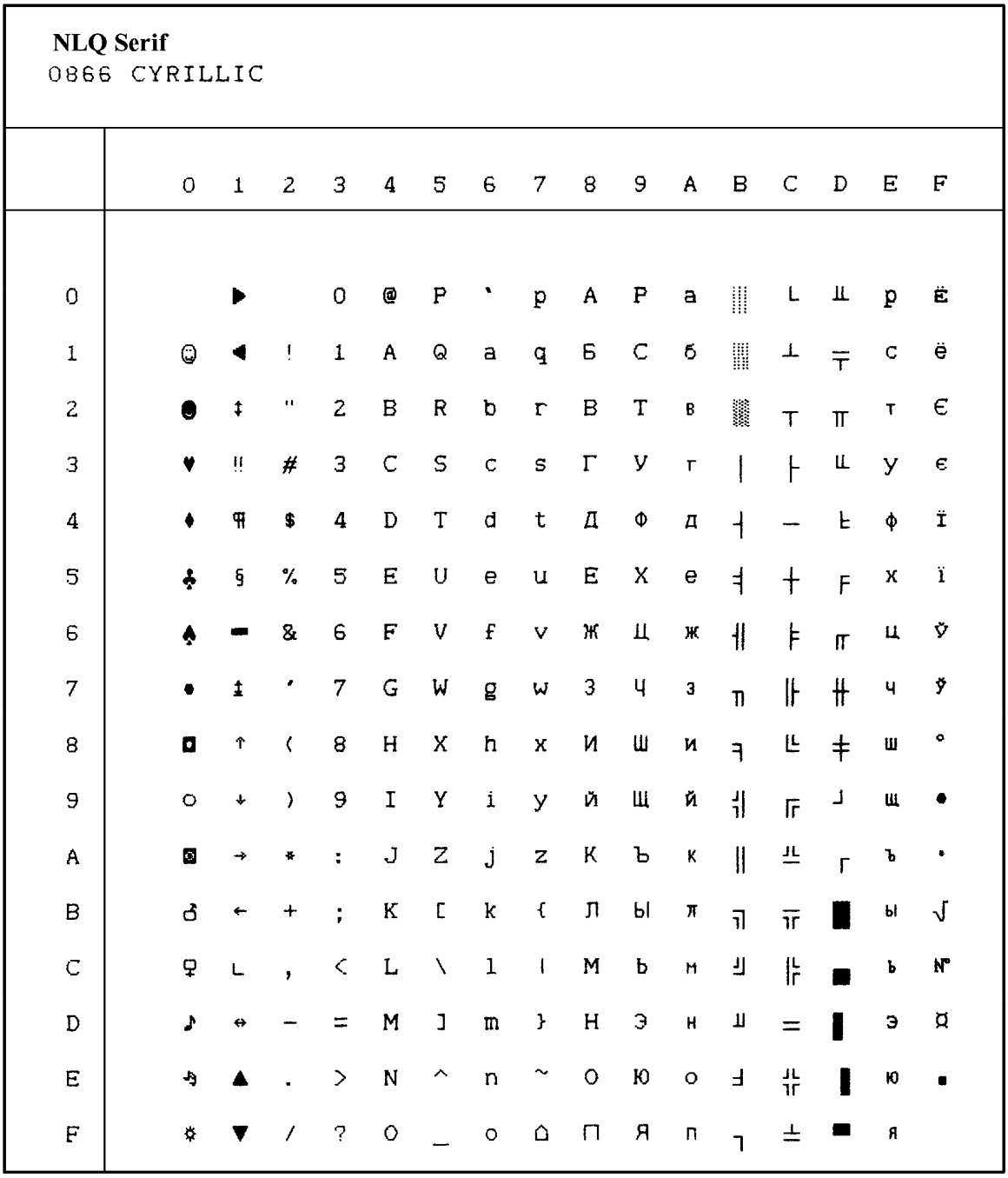
0864 ARABIC



NLQ Serif
0865 DANISH/NORWEGIAN



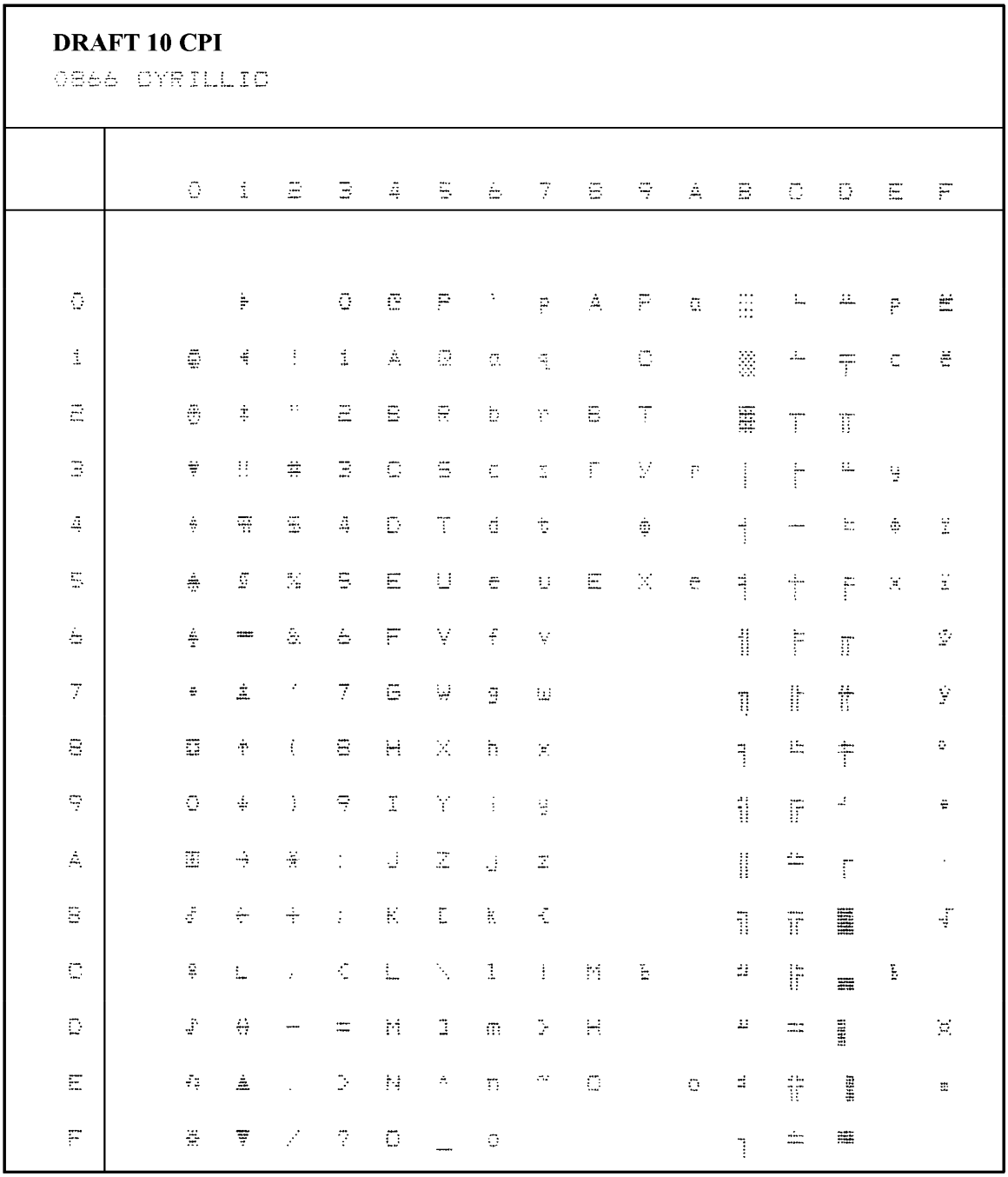
NLQ Serif
0866 CYRILLIC



	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0		▶		0	@	P	`	p	А	Р	а	▒	└	╨	р	ё
1	☺	◀	!	1	A	Q	a	q	Б	С	б	▒	┴	╤	с	ё
2	☻	↕	"	2	B	R	b	r	В	Т	в	▓	┬	╥	т	Є
3	♥	‼	#	3	C	S	c	s	Г	У	г	│	├	╙	у	є
4	♦	¶	$	4	D	T	d	t	Д	Ф	д	┤	─	╘	ф	Ї
5	♣	§	%	5	E	U	e	u	Е	Х	е	┼	┼	╒	х	ї
6	♠	▬	&	6	F	V	f	v	Ж	Ц	ж	╟	╞	╓	ц	Ў
7	•	↨	'	7	G	W	g	w	З	Ч	з	╖	╟	╫	ч	ў
8	◘	↑	(	8	H	X	h	x	И	Ш	и	╕	╚	╪	ш	°
9	○	↓	)	9	I	Y	i	y	й	Щ	й	╣	╔	┘	щ	∙
A	◙	→	*	:	J	Z	j	z	К	Ъ	к	║	╩	┌	ъ	·
B	♂	←	+	;	K	[	k	{	Л	Ы	л	╗	╦	▉	ы	√
C	♀	∟	,	<	L	\	l	|	М	Ь	м	╝	╠	▄	ь	№
D	♪	↔	-	=	M	]	m	}	Н	Э	н	╜	═	▌	э	¤
E	♫	▲	.	>	N	^	n	~	О	Ю	о	╛	╬	▐	ю	■
F	☼	▼	/	?	O	_	o	⌂	П	Я	п	┐	╧	▀	я	

DRAFT 10 CPI

CODE CYRILLIC



NLQ Serif
0869 GREEK NEW

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0		▶		0	@	P	`	p		Ί	ΐ	▒	└	Τ	ζ	–
1	☺	◀	!	1	A	Q	a	q		Ϊ	ΰ	▒	┴	Υ	η	±
2	☻	↕	"	2	B	R	b	r		Ό	ό	▓	┬	Φ	ϑ	υ
3	♥	‼	#	3	C	S	c	s			ύ	│	├	Χ	ι	φ
4	♦	¶	$	4	D	T	d	t			Α	┤	─	Ψ	κ	χ
5	♣	§	%	5	E	U	e	u		Ύ	Β	Κ	┼	Ω	λ	§
6	♠	▬	&	6	F	V	f	v	Ά	Ύ	Γ	Λ	Π	α	μ	ψ
7	•	↨	'	7	G	W	g	w		Ώ	Δ	Μ	Ρ	β	ν	′
8	◘	↑	(	8	H	X	h	x	•	Ώ	Ε	Ν	╚	γ	ξ	°
9	○	↓	)	9	I	Y	i	y	¬	²	Ζ	╣	╓	┘	ο	¨
A	◙	→	*	:	J	Z	j	z	¦	³	Η	║	╩	┌	π	ω
B	♂	←	+	;	K	[	k	{	`	ά	½	╗	╤	█	ρ	ϋ
C	♀	∟	,	<	L	\	l	|	′	£	Θ	╝	╟	▄	σ	ύ
D	♪	↔	–	=	M	]	m	}	Έ	έ	Ι	Ξ	═	δ	ς	ώ
E	♫	▲	.	>	N	^	n	~	—	ή	«	Ο	╬	ε	τ	■
F	☼	▼	/	?	O	_	o	⌂	Ή	ί	»	┐	Σ	▄	′	

NLQ Serif
0874 THAI

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0				0	@	P	`	p			฀	ฐ	ภ	ะ	เ	๐
1			!	1	A	Q	a	q			ก	ฑ	ม	ั	แ	๑
2			"	2	B	R	b	r			ข	ฒ	ย	ำ	โ	๒
3			#	3	C	S	c	s			ฃ	ณ	ร	ิ	ใ	๓
4			$	4	D	T	d	t			ค	ด	ฤ	ี	ไ	๔
5			%	5	E	U	e	u			ฅ	ต	ล	ึ	ๅ	๕
6			&	6	F	V	f	v			ฆ	ถ	ฦ	ื	ๆ	๖
7			'	7	G	W	g	w			ง	ท	ว	ุ	็	๗
8			(	8	H	X	h	x			จ	ธ	ศ	ู	่	๘
9			)	9	I	Y	i	y			ฉ	น	ษ	ฺ	้	๙
A			*	:	J	Z	j	z			ช	บ	ส	๋	๊	๚
B			+	;	K	[	k	{			ซ	ป	ห		๋	๛
C			,	<	L	\	l	|		ฌ	ผ	ฬ		์	¢
D			-	=	M	]	m	}			ญ	ฝ	อ	+	๎	¬
E			.	>	N	^	n	~			ฎ	พ	ฮ	๏	๎	¦
F			/	?	O	_	o				ฏ	ฟ	ฯ	๏	๏	

NLQ Sans Serif
0874 THAI

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0				0	@	P	'	p								
1			!	1	A	Q	a	q								
2			"	2	B	R	b	r								
3			#	3	C	S	c	s								
4			$	4	D	T	d	t								
5			%	5	E	U	e	u								
6			&	6	F	V	f	v								
7			'	7	G	W	g	w								
8			(	8	H	X	h	x								
9			)	9	I	Y	i	y								
A			*	:	J	Z	j	z						•		
B			+	;	K	[	k	{								
C			,	<	L	\	l	|								¢
D			-	=	M	]	m	}								¬
E			.	>	N	^	n	~								¦
F			/	?	O	_	o									

DRAFT 10 CPI

0874 THAI

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0				0	@	P	`	p								
1			!	1	A	Q	a	q								
2			"	2	B	R	b	r								
3			#	3	C	S	c	s								
4			$	4	D	T	d	t								
5			%	5	E	U	e	u								
6			&	6	F	V	f	v								
7			'	7	G	W	g	w								
8			(	8	H	X	h	x								
9			)	9	I	Y	i	y								
A			*	:	J	Z	j	z								
B			+	;	K	[	k	{								
C			,	<	L	\	l	|								¢
D			-	=	M	]	m	}								¬
E			.	>	N	^	n	~								¦
F			/	?	O	_	o									

□876 OCR A

	□	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
□				□	@	P	`	p								
1			!	1	A	Q	a	q						Ñ		
2			"	2	B	R	b	r								
3			#	3	C	S	c	s			£			ó		
4			$	4	D	T	d	t					Ä	Ÿ	ä	ÿ
5			%	5	E	U	e	u			¥		Å		å	
6			&	6	F	V	f	v			|		Æ	ö	æ	ö
7			'	7	G	W	g	w								
8			(	8	H	X	h	x				¬	_	Ø		
9			)	9	I	Y	i	y								
A			*	:	J	Z	j	z					I			
B			+	;	K	[	k	{					I			ß
C			,	<	L	\	l	|						ü		ü
D			-	=	M	]	m	}			^		I			
E			.	>	N	^	n	ß					-			
F			/	?	O	Y	o				-					

0877 OCR B

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0				0	@	P	'	p					↑	Z		z
1			!	1	A	Q	a	q			¡		↓	Ñ		
2			"	2	B	R	b	r					→			
3			#	3	C	S	c	s			£			ò		
4			$	4	D	T	d	t			¤	'	Ä		ä	
5			%	5	E	U	e	u			¥		Å		å	
6			&	6	F	V	f	v			¦		Æ	ö	æ	ö
7			'	7	G	W	g	w			§				ç	
8			(	8	H	X	h	x				-	_	Ø		ø
9			)	9	I	Y	i	y							é	
A			*	:	J	Z	j	z					I		ë	
B			+	;	K	[	k	{					I			
C			,	<	L	\	l	¦						Ü		
D			-	=	M	]	m	}			^		_I	IJ		ij
E			.	>	N	^	n	~					-			
F			/	?	O	_	o				-	¿	_	ß		

NLQ Serif
0912 ISO LATIN 2 PC

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0				0	@	P	`	p				°	Ŕ	Đ	ŕ	đ
1			!	1	A	Q	a	q			Ą	ą	Á	Ń	á	ń
2			"	2	B	R	b	r			˘	˛	Â	Ň	ă	ň
3			#	3	C	S	c	s			Ł	ł	Ă	ó	ă	ó
4			$	4	D	T	d	t			¤	´	Ä	ô	ä	ő
5			%	5	E	U	e	u			Ľ	ľ	Ĺ	ő	Ĺ	ö
6			&	6	F	V	f	v			Ś	ś	ć	ö	Ć	ö
7			'	7	G	W	g	w			§	ˇ	Ç	×	ç	÷
8			(	8	H	X	h	x			¨	¸	Č	Ř	č	ř
9			)	9	I	Y	i	y			Š	š	É	Ů	é	ů
A			*	:	J	Z	j	z			Ş	ş	Ę	Ú	ę	ú
B			+	;	K	[	k	{			Ť	ť	Ë	Ű	ë	ű
C			,	<	L	\	l	|		Ź	ź	Ě	Ü	ě	ü
D			-	=	M	]	m	}			-	˝	Í	Ý	í	ý
E			.	>	N	^	n	~			Ž	ž	Î	Ţ	î	ţ
F			/	?	O	_	o				Ż	ż	Ď	ß	ď	˙

NLQ Serif

0915 ISO CYRILLIC PC

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0				0	@	P	`	p				А	Р	а	р	№
1			!	1	A	Q	a	q			ё	Б	С	б	с	ё
2			"	2	B	R	b	r			ђ	В	Т	в	т	к
3			#	3	C	S	c	s			ѓ	Г	У	г	у	ѓ
4			$	4	D	T	d	t			є	Д	Ф	д	ф	є
5			%	5	E	U	e	u			ѕ	Е	Х	е	х	ѕ
6			&	6	F	V	f	v			і	Ж	Ц	ж	ц	і
7			'	7	G	W	g	w			ї	З	Ч	з	ч	ї
8			(	8	H	X	h	x			ј	И	Ш	и	ш	ј
9			)	9	I	Y	i	y			љ	Й	Щ	й	щ	љ
A			*	:	J	Z	j	z			њ	К	Ъ	к	ъ	њ
B			+	;	K	[	k	{			ћ	Л	Ы	л	ы	ћ
C			,	<	L	\	l	|		ќ	М	Ь	м	ь	ќ
D			-	=	M	]	m	}				Н	Э	н	э	§
E			.	>	N	^	n	~			ў	О	Ю	о	ю	ў
F			/	?	O	_	o				џ	П	Я	п	я	џ

DRAFT 10 CPI

0915 ISO CYRILLIC PC

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0				0	@	P	`	p				А	Р	а	р	
1			!	1	A	Q	a	q			Ё		С		с	ё
2			"	2	B	R	b	r				В	Т			
3			#	3	C	S	c	s				Г	У	г	у	
4			$	4	D	T	d	t					Ф		ф	
5			%	5	E	U	e	u			Є	Е	Х	е	х	ѕ
6			&	6	F	V	f	v			І					і
7			'	7	G	W	g	w			Ї					ї
8			(	8	H	X	h	x			Ј					ј
9			)	9	I	Y	i	y								
A			*	:	J	Z	j	z								
B			+	;	K	[	k	{								ћ
C			,	<	L	\	l	|				М	Ь		Ь	
D			-	=	M	]	m	}			-	Н				ѝ
E			.	>	N	^	n	~			Ў	О		о		ў
F			/	?	O	_	o									

NLQ Serif
0921 IS BALTIC MULTILINGUAL

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0				0	@	P	`	p				°	Ą	Š	ą	š
1			!	1	A	Q	a	q			"	±	Į	Ń	į	ń
2			"	2	B	R	b	r			¢	²	Ā	Ņ	ā	ņ
3			#	3	C	S	c	s			£	³	ć	Ó	Ć	ó
4			$	4	D	T	d	t			¤	'	Ä	Ō	ä	ō
5			%	5	E	U	e	u			„	µ	Å	õ	å	õ
6			&	6	F	V	f	v			¦	¶	Ę	Ö	ę	ö
7			'	7	G	W	g	w			§	·	Ē	×	ē	÷
8			(	8	H	X	h	x			Ø	ø	č	Ų	Č	ų
9			)	9	I	Y	i	y			©	¹	Ź	Ł	é	ł
A			*	:	J	Z	j	z			Ŗ	ç	ź	Ś	ź	ś
B			+	;	K	[	k	{			«	»	Ė	Ū	ė	ū
C			,	<	L	\	l	|		¬	¼	Ģ	Ü	ģ	ü
D			-	=	M	]	m	}			-	½	Ķ	Ż	ķ	ż
E			.	>	N	^	n	~			®	¾	Ī	Ž	Ī	ž
F			/	?	O	_	o				Æ	æ	Ļ	ß	ļ	'

NLQ Serif

1046 ARABIC EXTENDED

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0				0	@	P	`	p	ـٍ	ـُ		•	ﻋ	ذ	ـ	،
1			!	1	A	Q	a	q	×	ـِ	ﹷ	ا	ء	ر	ﻓ	ّ
2			"	2	B	R	b	r	÷	ـّ	ﺋ	؟	آ	ز	ق	ْ
3			#	3	C	S	c	s	ﺲ	ـٌ	ﺊ	٣	٢	س	ﻚ	ﻗ
4			$	4	D	T	d	t	ﺶ	ـَ	¤	٤	ؤ	ش	ل	ﻛ
5			%	5	E	U	e	u	ﺺ	ﺊ	ﺪ	٥	إ	ص	ﻢ	ﻠ
6			&	6	F	V	f	v	ﺾ	ى	ﺜ	٦	ئ	ض	ن	ـ
7			'	7	G	W	g	w	ـَّ	ﻴ	ﺒ	٧	ا	ط	ﻫ	ﻵ
8			(	8	H	X	h	x		ى	ﺘ	٨	ب	ظ	و	ﻷ
9			)	9	I	Y	i	y	■	غ	ﺜ	٩	ة	ع	ى	ﻹ
A			*	:	J	Z	j	z	|	ﻐ	ﺠ	ﺸ	ت	غ	ى	ﻻ
B			+	;	K	[	k	{	—	ﻐ	ﺤ	؛	ث	ﻌ	ً	ﻤ
C			,	<	L	\	l	¦	┐	ﻵ	،	ﺼ	ج	ﺢ	ُ	ﻨ
D			–	=	M	]	m	}	┌	ﻷ	-	ﺿ	ح	ﺆ	ٍ	ﻬ
E			.	>	N	^	n	~	└	ﻹ	ﺨ	ع	خ	└	َ	ه
F			/	?	O	_	o		┘	ﻻ	ﺴ	؟	ﺪ	ﻔ	ْ	

NLQ Sans Serif

1046 ARABIC EXTENDED

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0				0	@	P	'	p								
1			!	1	A	Q	a	q	ˣ							
2			"	2	B	R	b	r	÷							
3			#	3	C	S	c	s								
4			$	4	D	T	d	t			¤					
5				5	E	U	e	u								
6			&	6	F	V	f	v								
7			'	7	G	W	g	w								
8			(	8	H	X	h	x								
9			)	9	I	Y	i	y	▪							
A				:	J	Z	j	z	|							
B			+	;	K	[	k	{	_							
C			,	<	L	\	l	|	┐							
D			-	=	M	]	m	}	┌		-					
E			.	>	N	^	n	~	└							
F			/	?	O	_	o		┘							

DRAFT 10 CPI

1046 ARABIC EXTENDED

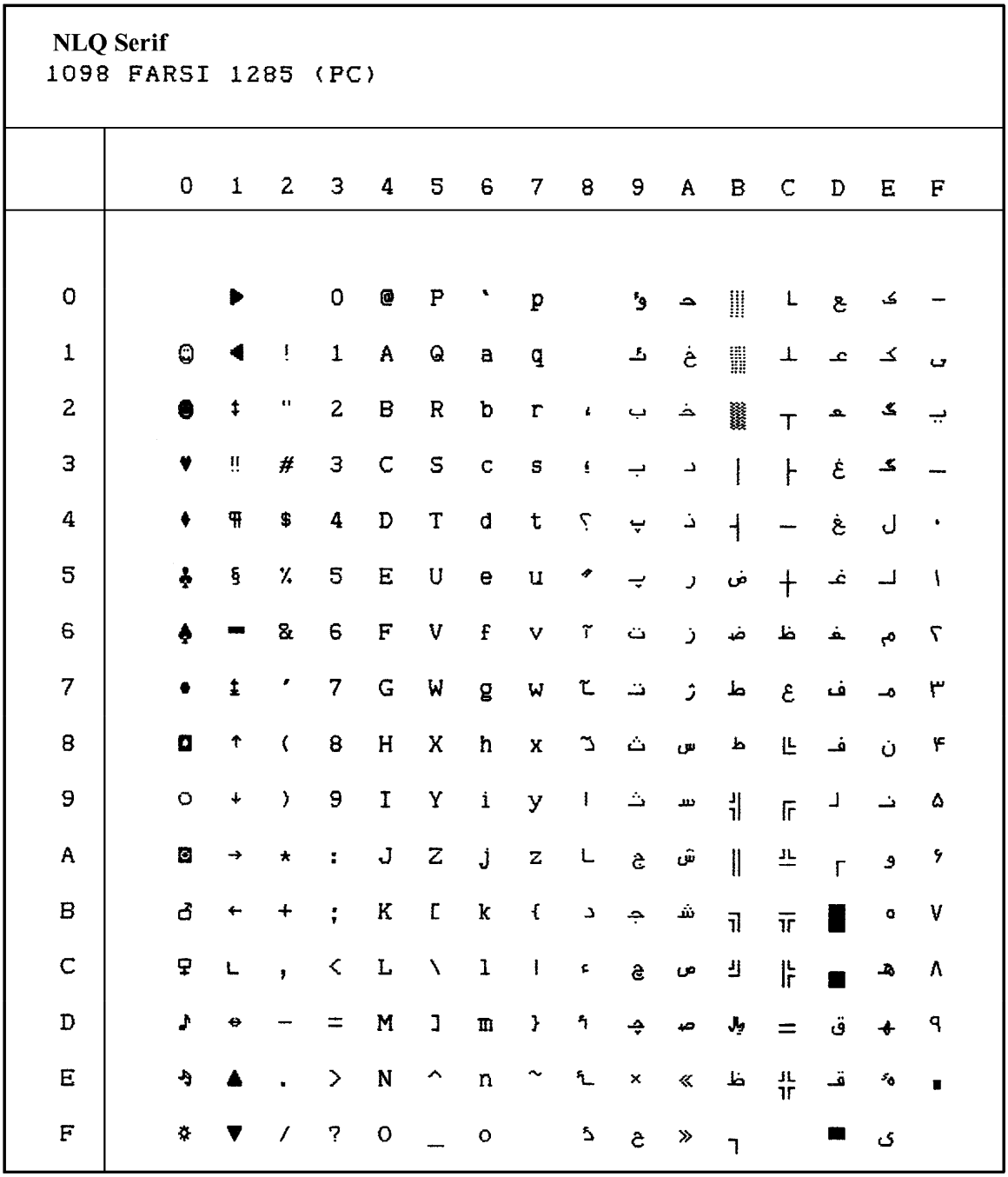
	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0				0	@	P	`	p	[illegible]	[illegible]		٠	[illegible]	[illegible]	ـ	[illegible]
1			!	1	A	Q	a	q	×	[illegible]	[illegible]	١	[illegible]	[illegible]	[illegible]	[illegible]
2			"	2	B	R	b	r	÷	[illegible]	[illegible]	٢	[illegible]	[illegible]	[illegible]	[illegible]
3			#	3	C	S	c	s	[illegible]	[illegible]	[illegible]	٣	[illegible]	[illegible]	[illegible]	[illegible]
4			$	4	D	T	d	t	[illegible]	[illegible]	[illegible]	٤	[illegible]	[illegible]	[illegible]	[illegible]
5			%	5	E	U	e	u	[illegible]	[illegible]	[illegible]	٥	[illegible]	[illegible]	[illegible]	[illegible]
6			&	6	F	V	f	v	[illegible]	[illegible]	[illegible]	٦	[illegible]	[illegible]	[illegible]	[illegible]
7			'	7	G	W	g	w	[illegible]	[illegible]	[illegible]	٧	[illegible]	[illegible]	[illegible]	[illegible]
8			(	8	H	X	h	x		[illegible]	[illegible]	٨	[illegible]	[illegible]	[illegible]	[illegible]
9			)	9	I	Y	i	y	■	[illegible]	[illegible]	٩	[illegible]	[illegible]	[illegible]	[illegible]
A			*	:	J	Z	j	z	│	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
B			+	;	K	[	k	{	─	[illegible]	[illegible]	؛	[illegible]	[illegible]	[illegible]	[illegible]
C			,	<	L	\	l	|	┐	[illegible]	،	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
D			-	=	M	]	m	}	┌	[illegible]	-	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
E			.	>	N	^	n	~	└	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
F			/	?	O	_	o		[illegible]	[illegible]	[illegible]	؟	[illegible]	[illegible]	[illegible]	

DRAFT 12 CPI

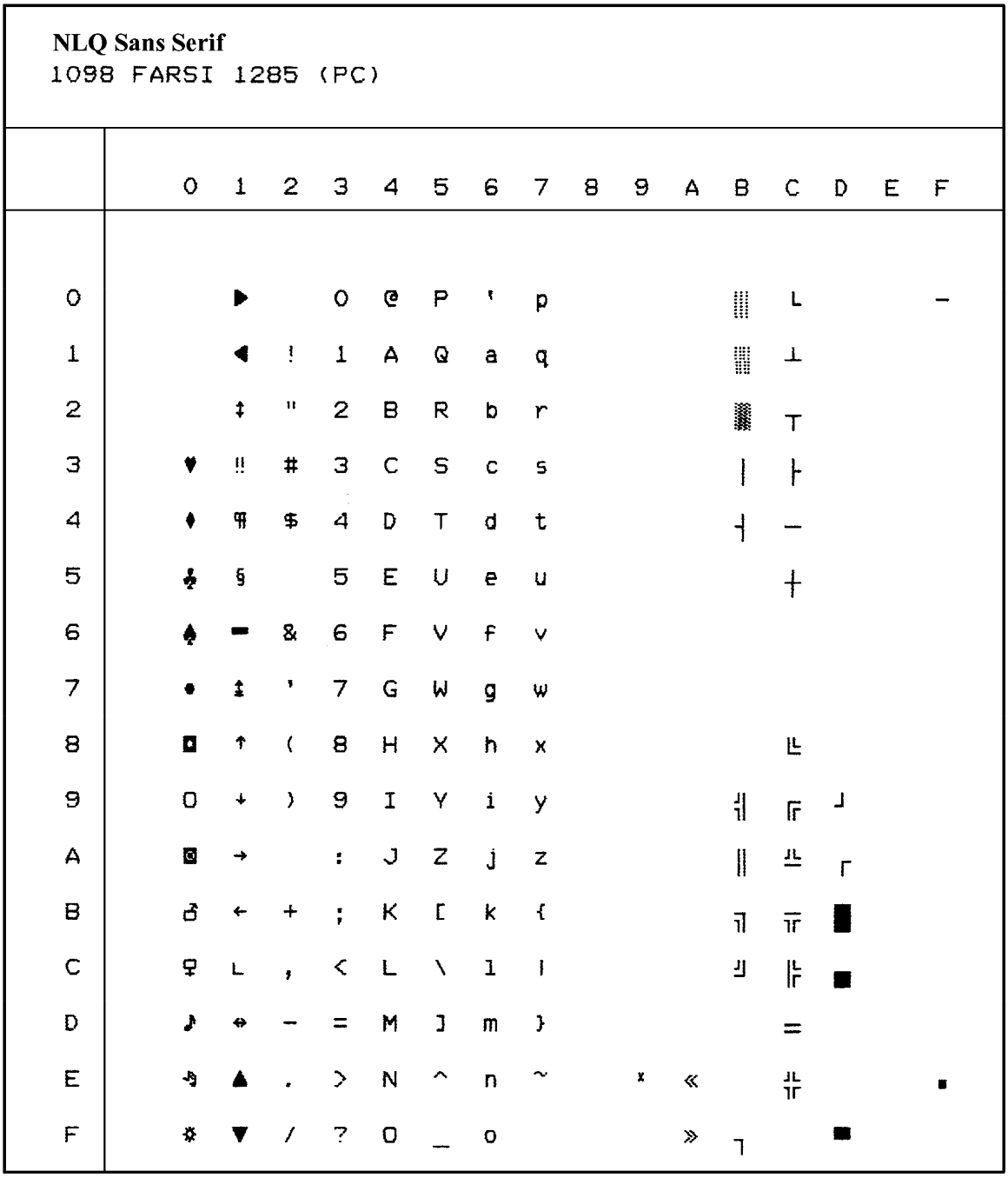
1046 ARABIC EXTENDED

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0				0	@	P	'	p								
1			!	1	A	Q	a	q	×							
2			"	2	B	R	b	r	÷							
3			#	3	C	S	c	s								
4			$	4	D	T	d	t			X					
5				5	E	U	e	u								
6			&	6	F	V	f	v								
7			'	7	G	W	g	w								
8			(	8	H	X	h	x								
9			)	9	I	Y	i	y	▪							
A				:	J	Z	j	z	▏							
B			+	;	K	[	k	{	─							
C			,	<	L	\	l	¦	┐							
D			-	=	M	]	m	}	┌		-					
E			.	>	N	^	n	~	└							
F			/	?	O	_	o		┘							

NLQ Serif
1098 FARSI 1285 (PC)

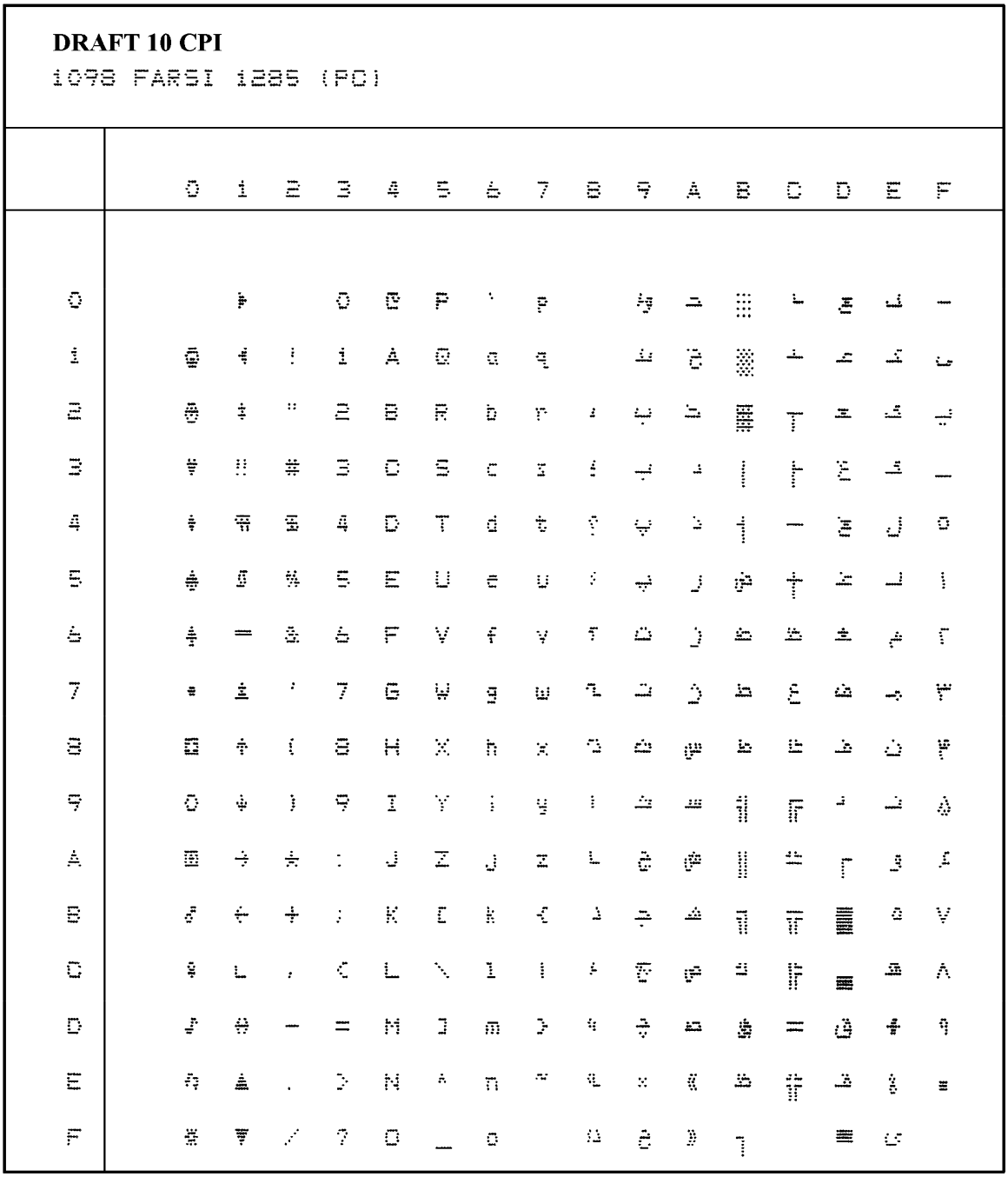


NLQ Sans Serif
1098 FARSI 1285 (PC)



DRAFT 10 CPI

1098 FARSI 1285 (PC)



DRAFT 12 CPI

1098 FARSI 1285 (PC)